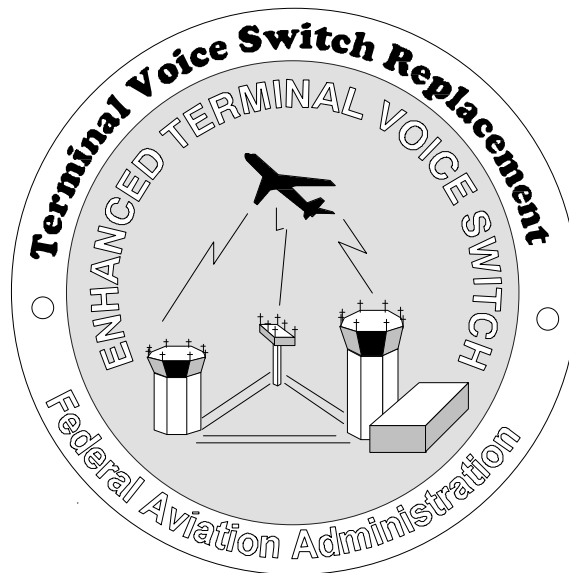


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**U.S. Department of Transportation
Federal Aviation Administration
Specification**

**Enhanced Terminal Voice Switch
(ETVS)**



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SECTION 1: INTRODUCTION

1. Introduction.

1.1. Scope.

This document lists requirements for the enhanced terminal voice switch (ETVS).

1.2. Document overview.

Section 1 (this section) of this specification describes the scope of this specification, gives an overview of this specification, and gives an overview of the ETVS. It is descriptive in nature and contains no binding requirements.

Section 2 of this specification lists the documents that are cited within subsequent sections as a part of binding requirements.

Section 3 lists system requirements.

Section 4 lists specialized verification requirements not covered in detail by the contract statement of work under which this specification is issued.

Section 5 is blank, because this specification imposes no requirements regarding preparation for delivery. These requirements may be found in the contract statement of work under which this specification is issued.

Section 6 contains notes, including an acronym listing and glossary. It is descriptive in nature and contains no binding requirements.

The appendices consist of several sections of system requirements, referred to within section 3, as well as a verification requirements traceability matrix (VRTM).

1.3. System overview.

The ETVS is to be an integrated voice switching system to be installed in government-owned and government-operated airport control towers. The ETVS is to provide air traffic control (ATC) personnel with access to both air-to-ground (A/G) and ground-to-ground (G/G) connectivity to support tower operations (local control, ground control, flight data, etc.). A functional block diagram of the ETVS is shown in figure 1-1.

1.3.1. Site characteristics.

The ETVS will be installed in two types of environments:

Airport traffic control tower (ATCT) cab. The ATCT cab is used for the control of air traffic that is landing at or departing the airport (including ground traffic). The ATCT cab is generally located at the top of a tower that can be as much as 300 feet high or more, and generally has fewer than ten positions. Some ATCT cabs incorporate approach control positions and so may require more ETVS position equipment for this function.

Radar approach control. The terminal radar approach control (TRACON FAA), Army radar approach control (ARAC USA), radar air traffic control facility (RATCF USN), and radar approach control (RAPCON USAF) are used for control of aircraft on approach or departure within radar range of the airport. Frequently, these facilities are located immediately below an ATCT cab (but are usually in closed rooms to facilitate visibility of the radar displays). These facilities may have ten or more positions.

When installed at U.S. military installations, the ETVS will also support the following specialized military functions:

Ground control approach (GCA). A GCA is a ground approach system operated from the ground by military (USA, USAF, USN) air traffic control personnel transmitting instructions to the pilot by radio. The approach may be conducted with surveillance radar only or with both surveillance and precision approach radar. GCAs are generally collocated with military approach control facilities. At military airports with remote FAA provided approach control service, the GCA is located on the military airport, in or next to the military control tower. A GCA may have as many as ten positions.

Fleet area control and surveillance facility (FACSFAC). FACSFACs are operated by the USN to provide management and control of offshore and inland operating areas, designated as special use airspace and dedicated to military use. They accomplish this mission through coordination, scheduling, and control of subsurface, surface, and airborne platforms operating within and transitioning to/from these areas. A FACSFAC may have as many as 25 positions.

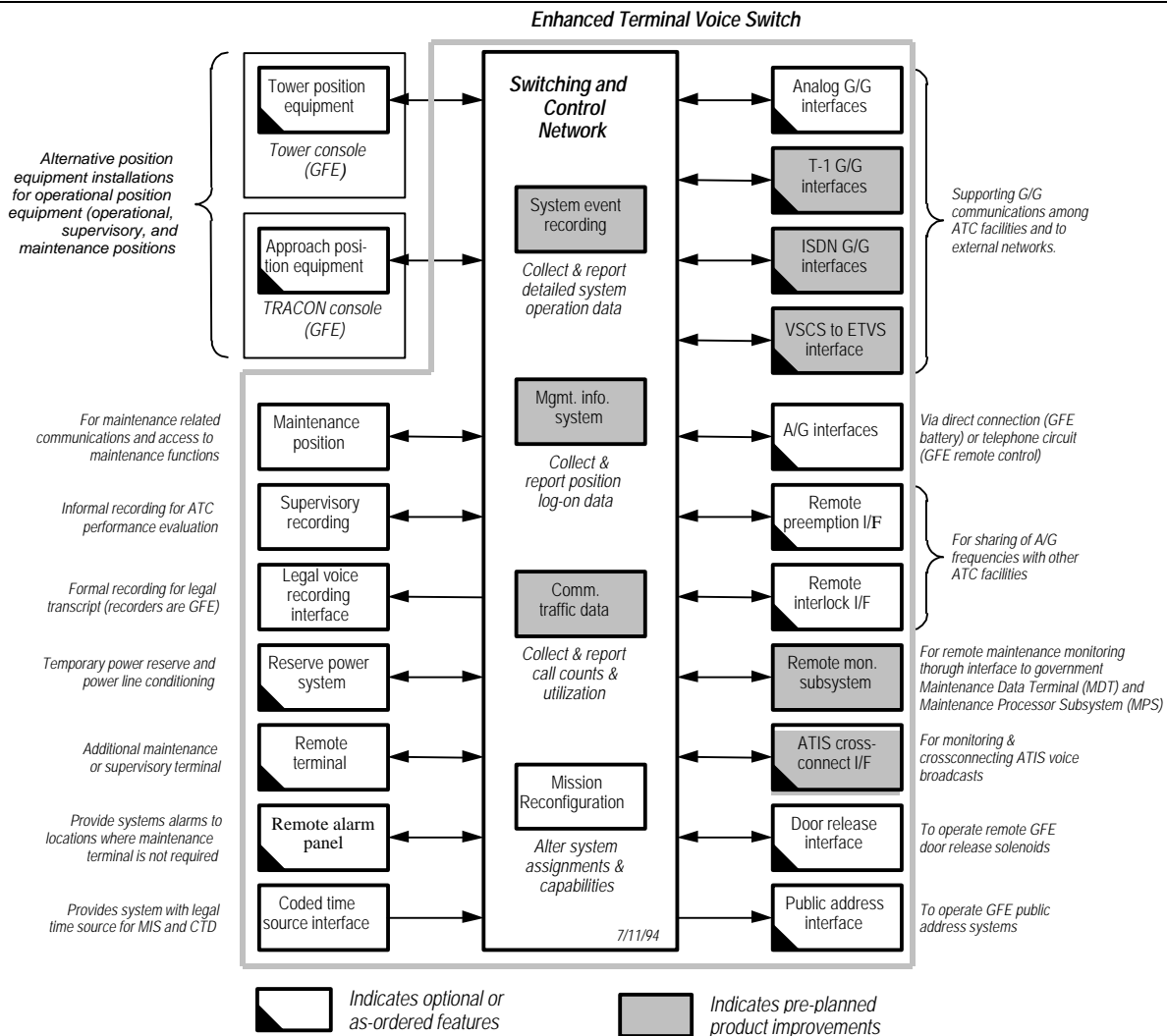


Figure 1-1. ETVS block diagram

Military radar unit (MRU). MRUs are operated by the USA, USAF, and USN to provide flight following and bomb scoring service to military aircraft operating in special use airspace. A large MRU has 20 positions.

1.3.2. Overview of requirements.

This specification is written in such a manner as to separate core system requirements from pre-planned product improvements. "Core requirements" are those requirements considered to be most basic to the operation of the ETVS; systems meeting the core requirements are to be deployed within a short time after contract award. "Pre-planned product improvements" are requirements considered to be less basic to the operation of the ETVS, or to require separate development effort; these requirements have been separated from the core requirements, will be

tracked in separate development efforts, and will be fitted as upgrades to systems already deployed.

The following sections of the specification are to be considered core requirements:

- Appendix A—core functional requirements
- Appendix B—core performance requirements
- Appendix C—core entry and display requirements
- Appendix D—core external interface requirements
- Appendix E—core physical design requirements
- Appendix F—analogue G/G interface requirements

- g) Appendix H–A/G interface requirements
- h) Appendix I–reliability, maintainability, and service life requirements.
- i) Appendix O–size and capacity requirements

The following sections of the specification are to be considered pre-planned product improvements:

- a) Appendix G–Digital G/G interface requirements
- b) Appendix J–Automated terminal information service (ATIS) support
- c) Appendix K–Management information system
- d) Appendix L–Communications traffic data (CTD) and system event collection and reporting
- e) Appendix M–Remote monitoring subsystem and maintenance data terminal interface

- f) Appendix N–Voice switching and control system (VSCS) to voice switch interface (Type 20 trunk)
- g) Appendix P–Four-jack position operation
- h) Appendix R–TED position enhancement and consolidation

1.4. Explanatory notes.

In lieu of a glossary, this specification provides definitions and background information in shaded “sidebars” preceded by the word “Note”. Offerors and contractors are hereby advised that these notes are provided for background information only and should not be construed as binding contractual requirements, or as implied requirements. In any case, where these notes are not understood, not believed correct, or believed to represent an implied requirement, the offeror or contractor must seek clarification from the government before relying on these notes.

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SECTION 2: APPLICABLE DOCUMENTS

2. Applicable documents.

The following documents form a part of this specification to the extent specified herein. In case of any discrepancy between these documents and specific requirements of this specification, this specification shall be considered the superseding document unless otherwise directed by the government.

Copies of government documents may be obtained as directed by the contracting officer.

Copies of non-government documents are generally available in technical libraries or may be obtained from their originators.

2.1. Government documents.

2.1.1. Specifications.

FAA-C-1217E; Electrical Work, Interior (January, 1991)

FAA-G-2100F; Electronic Equipment, General Requirements (November, 1993)

FAA-E-2603A; Noise Canceling Headset and Handset (October, 1977)

FAA-E-2162B; Microphone, Hand-Held (January 16, 1969)

MIL-S-22885E; Switches, Push Button, Illuminated, General Specification For (11 March 1992)

MIL-L-85762A: Lighting, Aircraft, Interior, Night Vision Imaging System (NVIS) Compatible (26 August 1988).

NAS-MD-793A; Remote Maintenance Monitoring Requirements; Functional Requirements for the Remote Monitoring Subsystem (date TBS)

2.1.2. Standards.

FAA-STD-019B; Lightning Protection, Grounding, Bonding, and Shielding Requirements for Facilities (September, 1990)

FAA-STD-020B; Transient Protection, Grounding, Bonding, and Shielding Requirements for Equipment (May, 1992)

FAA-STD-054; Use of Selective Signaling Standard for Voice Communications Systems (March 12, 1996)

MIL-STD-461D; Electromagnetic Emissions and Susceptibility Requirements for Control of Electromagnetic Interference (January, 1993)

MIL-STD-462D; Electromagnetic Interference Characteristics, Measurement of (January, 1993)

MIL-STD-471A, Note 2; Maintainability Verification Demonstration Evaluation (December, 1978)

MIL-STD-781D; Reliability Testing for Engineering Development, Qualification, and Production (1986)

2.3.3. Interface requirements documents.

NAS-IR-42004400; Voice Communication System to Digital NAS Interfacility Communications System (NICS) Service (date TBS)

NAS-IR-51035101; Remote Monitoring Subsystem/Maintenance Processor Subsystem (RMS/MPS) (30 July 1993)

NAS-IR-92020000 Rev. D; Coded Time Source/User Systems (CTS/User Systems) (15 February 1994)

2.3.4. Interface control documents.

NAS-IC-42018404; Voice Switching and Control System (VSCS) to the Trunks (14 January 1994)

2.3.5. Federal regulations.

Title 47 CFR Part 15; Radio Frequency Devices

Title 47 CFR Part 68; Federal Communications Commission Description of Standard Regulations Program Connection Configuration

2.2. Non-government documents.

American National Standards Institute (ANSI) IPC-T-50; Terms and Definitions for Interconnecting and Packaging Electronics Circuits

ANSI IPC-A-610; Acceptability of Printed Board Assemblies

ANSI S3.2-1989; Method for Measuring the Intelligibility of Speech Over Communications Systems

AT&T PUB 43201A; Private Line Interconnection Voice Applications (December, 1981)

AT&T PUB 43801; Digital Channel Bank-Requirements and Objectives (November 1982)

Bellcore TA-NPL-000436; Digital Network Synchronization Plan (Bellcore) (June, 1993)

Electronics Industries Association EIA-232D; Interface Between Data Terminal Equipment and Data Circuit Terminating Equipment Employing Serial Binary Data Interchange (January, 1987)

Electronics Industries Association/
Telecommunications Industries Association (TIA)
EIA/TIA-464A-1; Private Branch Exchange (PBX)
Switching Equipment for Voiceband Applications
(April 1992)

European Computer Manufacturers' Association
(ECMA) TR/40; Electrostatic Discharge Immunity
Testing of Information Technology Equipment (July,
1987)

International Electromechanical Commission IEC 801-
2; Electrostatic Discharge Requirements, Susceptibility

National Fire Protection Association, Inc. NFPA-70;
National Electrical Code 1993

SECTION 3: REQUIREMENTS

3. Requirements.

- a) The ETVS shall permit simultaneous operation of all operational positions to either place calls, receive calls, or both.
- b) The ETVS shall not cause unexpected or false operation at any operational position, supervisory position, maintenance position, radio interface, or trunk interface due to procedures performed at any other operational position, supervisory position, maintenance position, radio interface, or trunk interface, whether logical or not.

3.1. Functional requirements.

- a) The ETVS shall meet the core functional requirements in Appendix A of this specification.
- b) The ETVS shall meet the requirements for controls, displays, audio warnings, and labels in Appendix C of this specification.
- c) As ordered by the government, the ETVS shall be upgradeable to meet the ATIS support requirements in Appendix J of this specification.
- d) As ordered by the government, the ETVS shall be upgradeable to meet the management information system (MIS) requirements in Appendix K of this specification.
- e) As ordered by the government, the ETVS shall be upgradeable to meet the communications traffic data (CTD) and system event collection and recording requirements in Appendix L of this specification.
- f) As ordered by the government, the ETVS shall be upgradeable to meet the remote monitoring subsystem (RMS) and maintenance data terminal (MDT) requirements in Appendix M of this specification.
- g) As ordered by the government, the ETVS shall be upgradeable to meet the four jack position operation in Appendix P of this specification.

- h) As ordered by the government, the ETVS shall be upgradeable to meet the TED enhancement and consolidation requirements in Appendix R of this specification.

3.2. Performance requirements.

The ETVS shall meet the core performance requirements in Appendix B of this specification.

3.3. Physical design requirements.

- a) The ETVS shall meet the physical design requirements in Appendix E of this specification.
- b) The ETVS shall meet the reliability, maintainability, and service life requirements of Appendix I of this specification.
- c) The ETVS shall meet the size and capacity requirements of Appendix O of this specification.

3.4. External interface requirements.

- a) The ETVS shall meet the external interface requirements in Appendix D of this specification.
- b) The ETVS shall meet the analog G/G communications requirements in Appendix F of this specification.
- c) As ordered by the government, the ETVS shall be upgradeable to meet the digital G/G communications interface requirements in Appendix G of this specification.
- d) The ETVS shall meet the A/G communications interface requirements in Appendix H of this specification.
- e) As ordered by the government, the ETVS shall be upgradeable to meet the VSCS to voice switch interface requirements (Type 20) in Appendix N of this specification.

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SECTION 4: VERIFICATION REQUIREMENTS

4. Verification requirements.

4.1. Responsibilities for verification.

Compliance with each section 3 requirement may be verified at one or more of the following test phases, as identified in the VRTM.

4.1.1. First article test.

- a) As a necessary condition for further production, the first ETVS produced shall pass first article testing and evaluation against all requirements of this specification.
- b) First article testing shall be conducted according to test and evaluation procedures developed by the contractor and approved by the government in compliance with:
 - 1) The verification methods specified in the verification requirements traceability matrix (see Appendix Q);
 - 2) The specialized verification requirements specified in this chapter; and,
 - 3) The requirements of the contract statement of work.
- c) The system subjected to first article testing shall be the first production system ordered by the government with all optional features installed (excluding pre-planned product improvements not ready at time of initial deployment).

4.1.2. Production acceptance test.

- a) Each ETVS produced shall undergo production acceptance test and evaluation (PAT&E).
- b) The PAT&E shall be conducted by the contractor and approved by the government in compliance with:
 - 1) Procedures derived from those used in the first article test; and,
 - 2) The requirements of the contract statement of work.

4.1.3. Site test.

- a) Upon installation, and as a necessary condition for government acceptance, each ETVS produced shall pass a site test and evaluation.
- b) Site acceptance testing and evaluation shall be conducted according to procedures developed by the contractor and approved by the government in compliance with:
 - 1) The verification methods specified in the verification requirements traceability matrix; and,
 - 2) The requirements of the contract statement of work.

4.1.4. Technical field test and evaluation.

The ETVS shall undergo technical field testing and evaluation conducted by the government to ensure that the ETVS will operate in accordance with pertinent National Airspace System (NAS) system-level functional, performance, and interface requirements when configured and integrated into its operational environment.

4.2. Verification methods.

Compliance with each requirement of this specification shall be verified by one or more of the following methods as indicated in the verification requirements traceability matrix in Appendix Q:

- a) Test, in which quantitative measurements are taken of system response to pre-defined stimuli. These measurements are taken with standard laboratory equipment (e.g., voltmeter, thermometer) according to scenarios identified in the contract or subordinate documentation, and are then analyzed to ascertain compliance with requirements (examples: measuring the degree of harmonic distortion present in a transmission path).
- b) Demonstration, in which qualitative observations are made of system behavior in response to pre-defined stimuli. The observers (who may or may not require specialized training or experience) will report whether or not the system complies with requirements (examples: demonstration that displays are visible in pre-defined conditions of

ambient lighting; demonstration that system can originate ringdown calls).

- c) Inspection, in which the system is visually examined by observers (who may or may not require specialized training or experience) who will report whether or not the system complies with requirements (examples: inspecting parts for proper manufacturing procedures; inspecting the system to verify that it can support the required number of positions).
- d) Analysis, in which the system is modeled mathematically according to accepted techniques by analysts who will ascertain compliance based on the results of their computations (examples: estimation of system reliability from part failure rate data; estimation of blocking probability based on processor loading analysis).

4.3. Specialized verification requirements.

The following paragraphs describe specialized verification procedures for certain requirements of the specification.

4.3.1. FCC registration.

All ETVS components that connect to common carrier facilities shall be registered with the Federal Communications Commission in accordance with Title 47, CFR, part 68, and with Article 800-4 of NFPA-70.

4.3.2. Intelligibility.

The ETVS shall pass a phonetically balanced (PB) monosyllabic word test conducted in accordance with ANSI S3.2-1989 with a minimum score of:

- a) 90% for Outgoing communications (HS microphone to external interface)
- b) 90% for Incoming communications (external interface to HS earpiece).
- c) 89% for Incoming communications (external interface to position LS).

4.3.3. Electromagnetic compatibility.

4.3.3.1. FCC Part 15 testing and certification.

All ETVS equipment subject to FCC rules and regulations as set forth in 47 CFR part 15 shall be tested and certified to those standards.

4.3.3.2. MIL-STD-462D testing.

All ETVS equipment subject to meeting MIL-STD-461D criteria shall be tested in accordance with MIL-STD-462D

4.3.3.3. Radar pulse susceptibility testing.

All ETVS equipment subject to radar pulse susceptibility testing shall be tested in accordance with MIL-STD-462D for RS103 with the following modifications:

- a) The transmitter shall be modulated with a pulse train having a pulse width variable between 500 nanoseconds and 6 microseconds with a pulse repetition rate between 300 and 1500 pulses per second.
- b) The field intensity shall be 350 volts per meter.
- c) The frequency range of the test shall be from 1 gigahertz (GHz) to 18 GHz.

4.3.4. Electrostatic discharge (ESD) testing.

- a) The ETVS shall not sustain equipment malfunctions at a rate greater than 10% of the discharges at severity level 2 as specified in table 4-2 when subjected to ESD pulses having the waveform in Figure 4-1 and the maximum current and voltage limits specified under Level 1 in Table 4-1.
- b) The ETVS shall not sustain equipment malfunctions at a rate greater than 10% of the discharges at severity level 3 as specified in table 4-2 when subjected to ESD pulses having the waveform in Figure 4-1 and the maximum current and voltage limits specified under level 2 in Table 4-1.
- c) ESD testing shall be performed on a fully operational ETVS handling the communications test load described in 4.3.7.

- d) The ESD test generator shall simulate the human body contact model defined in paragraph 6 of IEC 801-2.
- e) The direct-injection test method shall be the preferred method of testing equipment, with the air discharge method available as an additional method for insulated devices as defined in IEC 801-2 and ECMA TR/40.
- f) The test method, test points, and number of test trials shall be determined by the ETVS contractor and approved by the government. ECMA TR/40 and IEC 801-2 can be used as guidelines for test simulators, test method selection, test point selection, and the number of test trials.
- b) The average background luminance B_b shall be determined from the arithmetical average of three measurements of luminance taken from different areas on the item under test (selector or display), with the item installed as in a production system, and in a completely de-energized state.
- c) The average lit-zone luminance B_{lit} shall be determined from the arithmetical average of three measurements of luminance taken from different areas on the transilluminated portion(s) of the item under test .
- d) The average unlit-zone luminance B_{unlit} shall be determined from the arithmetical average of three measurements of luminance taken from different areas on the non-luminated (blocked or opaque) portion(s) of the item under test.
- e) The contrast C_{lit} with respect to background of the lit portion of the display shall be computed from:

$$C_{lit} = \frac{B_{lit} - B_b}{B_b}$$

4.3.5. Reserved.

4.3.6. System maintainability demonstration.

- a) A maintainability demonstration shall be conducted on the ETVS to verify compliance with the requirements of this specification (see 90.3).
- b) The maintainability demonstration shall be conducted in accordance with MIL-STD-471A, using Test Method 8, Plan A1 and Plan B1 for all corrective maintenance.

- f) The contrast C_{unlit} with respect to the background of the unlit portion of the display shall be computed from:

$$C_{unlit} = \frac{B_{unlit} - B_b}{B_b}$$

4.3.7. Communications test load.

- a) As stipulated in this specification, certain requirements shall be verified while the system is under a communications test load equivalent to that described in table 4-3.
- b) The load shall be generated randomly and asynchronously over time.
- c) The load may be distributed randomly over positions and circuits.

- g) Items for which the offeror can produce authentic certification of compliance with MIL-S-22885E for sunlight readability may be excused by the government from further testing.

4.3.8. Test for sunlight readability of display elements.

4.3.8.1 Legend switches and indicators.

- a) The test for sunlight readability of display elements shall be carried out in accordance with paragraph 4.8.36 of MIL-S-22885E, subject to the modifications below.

4.3.8.2 Electronic and electro-optical displays

The test for minimum contrast shall be in accordance with paragraph 4.8.16.2 of MIL-L-85762A subject to modifications to specular and diffuse lighting conditions given elsewhere in this specification.

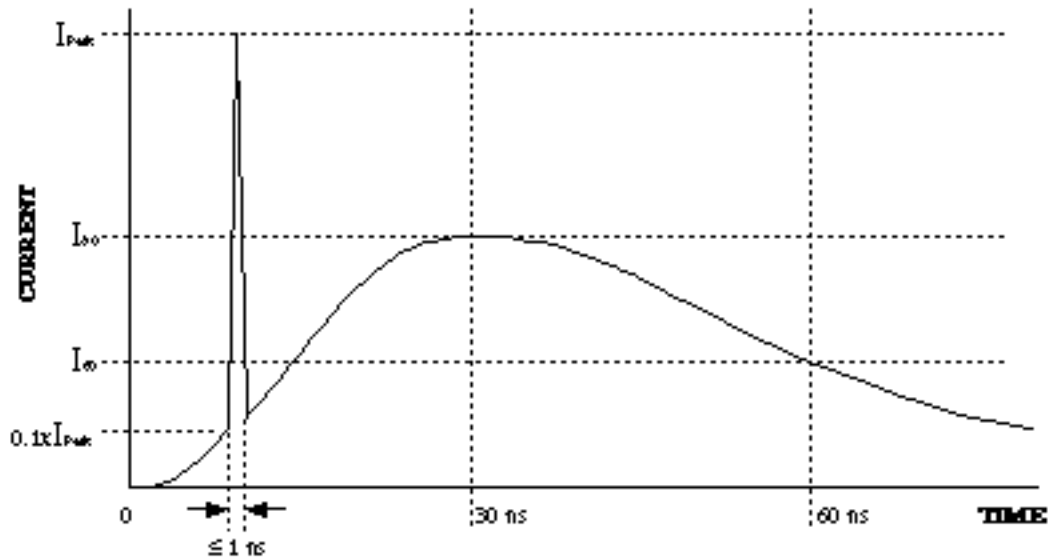


Figure 4-1. Electrostatic Discharge Test Waveform

Level	Simulator voltage, kV		Discharge current, A		
	Direct injector	Air discharge	I_{Peak}^a	I_{30}^b	I_{60}^b
1	6	15	22.5	12.0	6.0
2	8	20	30.0	16.0	8.0

a. Within $\pm 10\%$
b. Within $\pm 30\%$

Table 4-1. Voltage and current limits for electrostatic discharge testing

Severity level	Effect
0	Transient disturbances with no lasting effects
1	Not indicated as machine error, but recognized by end-user as unsuccessful operation and can be corrected by end-user with manual retry.
2	Indicated as machine error and can be corrected by end-user with manual retry.
3	Indicated as machine error and must be corrected by system restart.
4	Critical error <ul style="list-style-type: none"> a) Undetected error. b) Loss of data c) Restart effort high. d) Operational safety affected. e) Equipment damage.

Table 4-2. Electrostatic discharge failure criteria

Event type	Average no. of events per hour	Average holding time per event
A/G transmission	300 PTTs \times no. of positions	3 seconds
A/G reception	300 squelch breaks \times no. of receivers	3 seconds
IC calls	10 \times no. of positions	20 seconds
Non-IC calls placed	10 \times no. of positions	1 minute
Non-IC calls received	10 \times no. of circuit interfaces	1 minute

Table 4-3. Communications test load

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SECTION 5: PREPARATION FOR DELIVERY

5. Preparation for delivery.

Refer to the contract statement of work under which this specification is issued.

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SECTION 6: ABBREVIATIONS, ACRONYMS, AND SYMBOLS

6. Abbreviations, acronyms, and symbols.

OTLP	zero transmission level point	IA	indirect access
A/G	air to ground	IC	intercom
AAS	advanced automation system	IDF	intermediate distribution frame
ac	alternating current	IP	interphone
ACCC	area control computer complex	ISDN	integrated services digital network
ALBO	automatic line build-out	kHz	kilohertz
ALOD	automatic lockout device	lb/ft ²	pound-force per square foot
ANSI	American National Standards Institute	LINCS	leased interfacility NAS communications system
ARAC	Army radar approach control	LS	loudspeaker
ATC	air traffic control	M/S	main/standby
ATCT	airport traffic control tower	MCF	metroplex control facility
ATIS	automated terminal information service	MDT	maintenance data terminal
ATS	administrative telephone system	MHz	megahertz
B+D	bearer plus data (ISDN channels)	MIC	microphone
B8ZS	bipolar transmission with eight-zero substitution	MIS	management information system
BRI	basic rate interface	MPS	maintenance processor subsystem
°C	degrees Celsius	ms	millisecond
CA	common answer	OJT	on-the-job training
CO	central office	OTS	over-the-shoulder
CTD	communications traffic data	OVR	override
DA	direct access	PABX	private automated branch exchange
dB	decibels	PRI	primary rate interface
dBa	decibels acoustical	PSTN	public switched telephone network
dBm	decibels relative to one milliwatt	PTT	push-to-talk
dBm0	decibels relative to one milliwatt measured at the 0TLP	RAPCON	radar approach control
dBm	decibels relative to one picowatt unweighted	RATCF	radar air traffic control facility
dBmC	decibels relative to one picowatt C-message weighted	RMMS	remote maintenance monitoring system
dB SPL	decibels sound pressure level	RMS	remote monitoring subsystem
dc	direct current	RX	receive
DoD	Department of Defense	SF	single frequency
DS-1	digital signal 1 (primary level, digital multiplexing hierarchy)	SS	signaling system
DSN	defense switched network	TCCC	tower control computer complex
DTMF	dual-tone multi-frequency	TED	touch-entry display
E&M	ear and mouth	TIA	Telecommunications Industries Association
EIA	Electronics Industries Association	TL	transmission level
ESF	extended superframe	TLP	transmission level point
ETVS	enhanced terminal voice switch	TRACON	terminal radar approach control
FAA	Federal Aviation Administration	TX	transmit
FTS	federal telecommunications system	USA	United States Army
G/G	ground-to-ground	USAF	United States Air Force
GFE	government-furnished equipment	USN	United States Navy
GHz	gigahertz	V	Volts
HS	headset and handset	VA	volt-amperes
Hz	Hertz	VOX	voice operated switch or voice operated circuit
		VRTM	verification requirements traceability matrix
		VSCS	voice switching and control system

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APPENDIX A: CORE FUNCTIONAL REQUIREMENTS

10. Core functional requirements.

10.1. Description and remarks.

This appendix provides basic system functional requirements that the ETVS must meet.

10.2. Position types.

10.2.1. Operational position.

- a) The ETVS shall provide operational positions for air traffic controllers and specialists.
- b) The number, location, and configuration of such positions will be identified at time of order, subject to the requirements of Appendix O.
- c) Each operational position shall provide the operator with control of the functions identified in table 10-1.
 - 1) For each entry reading "Required" under the "Operational position" heading, the ETVS shall provide the function on each operational position.
 - 2) For each entry reading "Not required" under the "Operational position" heading, the ETVS is not required to provide the function on any operational position.
 - 3) For each entry reading "As ordered" under the "Operational position" heading, the ETVS shall provide each operational position with the function in quantities and configurations to be specified at time of order.

10.2.2. Supervisory position.

- a) The ETVS shall provide supervisory positions for air traffic supervisors.
- b) The number, location, and configuration of such positions will be identified at time of order, subject to the requirements of Appendix O.
- c) Each supervisory position shall provide the operator with control of the functions identified in table 10.1.

- 1) For each entry reading "Required" under the "Supervisory position" heading, the ETVS shall provide the function on each supervisory position.
- 2) For each entry reading "Not required" under the "Supervisory position" heading, the ETVS is not required to provide the function on any supervisory position.
- 3) For each entry reading "As ordered" under the "Supervisory position" heading, the ETVS shall provide each supervisory position with the function in quantities and configurations to be specified at time of order.

Note: The supervisory positions will generally be located among or near the positions over which the supervisor has authority; the supervisor will require access to G/G, and in some cases, A/G communications resources.

10.2.3. Maintenance position.

- a) The ETVS shall provide maintenance positions for maintenance technicians.
- b) The number, location, and configuration of such positions will be identified at time of order, subject to the requirements of Appendix O.
- c) Each maintenance position shall provide the operator with control of the functions identified in table 10-1.
 - 1) For each entry reading "Required" under the "Maintenance position" heading, the ETVS shall provide the function on each maintenance position.
 - 2) For each entry reading "Not required" under the "Maintenance position" heading, the ETVS is not required to provide the function on any maintenance position.
 - 3) For each entry reading "As ordered" under the "Maintenance position" heading, the ETVS shall provide each maintenance position with the function in quantities and configurations to be specified at time of order.

Function	Paragraph reference	Operational position	Supervisory position	Maintenance position
A/G communications	10.3.1	As ordered	As ordered	As ordered
G/G communications	10.3.2	As ordered	As ordered	As ordered
Operational pos. controls	10.3.3	As ordered	As ordered	As ordered
Access restriction	10.3.4	Not required	Required	Required
Maintenance and testing	10.3.5	Not required	Not required	Required
Supervisory functions	10.3.6	Not required	Required	Not required
Mission reconfiguration	10.3.7	Not required	Required	Required
System expansion	10.3.8	Not required	Not required	Required
Radio and trunk legal recording	10.3.9	Not required	Not required	As ordered

Table 10-1 Assignment of functions to position types

Note: The maintenance position will generally be located in or adjacent to the ETVS central equipment, so that the maintenance technician can have easy access to test points, distribution frames, and other items that would not be available at a remoted maintenance terminal. The maintenance position requires the capability to communicate on ATC circuits and frequencies (as directed by ATC personnel) for test and maintenance purposes..

10.3. Position functions.

10.3.1. A/G communications functions.

10.3.1.1. Frequency add and delete

- a) As authorized by classmark, the ETVS shall permit operators to add frequencies to their position up to the physical limit of available frequency selectors at the position.
- b) As authorized by classmark, the ETVS shall permit operators to drop frequencies from their position.
- c) The ETVS shall not permit frequency add and delete operations to affect operations at other positions.

10.3.1.2. Frequency forwarding

- a) The ETVS shall permit operators to temporarily forward control of their assigned frequencies to another position, subject to the number of frequencies being forwarded and the number of

frequency selectors available at the forwarded-to position.

- b) The frequency forwarding shall have the effect of adding to the forwarded-to position all those frequencies of the forwarding position that are not already assigned to the forwarded-to position.
- c) The ETVS shall discontinue the attempt and provide an error indication to the position attempting to forward frequencies whenever the attempt cannot proceed (i.e., due to error in entry, forwarding or forwarded-to positions already accepting forwarded frequencies, or insufficient frequency selectors at the forwarded-to position).
- d) The ETVS shall provide indication of confirmation of frequency forwarding to both the forwarding and forwarded-to positions.
- e) The ETVS shall require positive confirmation by the operator of the forwarded-to position before executing a frequency-forwarding command.
- f) The ETVS shall discontinue frequency forwarding upon appropriate action by the forwarded-to position.
- g) Frequency forwarding activities (including discontinuation) shall not interfere with ATC communications operations at either position.
- h) The ETVS shall not permit any position to accept frequency forwarding from more than one position at a time, nor forward its own frequencies while it has control of frequencies forwarded from another position (e.g., A forwards

to B; B not allowed to forward to C, nor B allowed to accept forwarding from any other position).

Note: The frequency forwarding function is intended to allow controllers to transfer their A/G workload temporarily

10.3.1.3. Transmit controls.

10.3.1.3.1. Select/deselect transmitter.

Note: To “select” a transmitter is to choose it for transmission. Transmitters so selected would not actually be activated until PTT is given.

- a) For each non-emergency frequency at each position, the ETVS shall permit the operator to select and deselect the transmitter associated with the frequency.
- b) The ETVS shall permit selection and deselection to be accomplished with a single touch action of a latching selector.
- c) Upon selection of a transmitter, the ETVS shall furnish all future push-to-talk (PTT) commands to the on-line (either main or standby) A/G frequency transmitter interface.
- d) Upon deselection of a transmitter, the ETVS shall withhold future PTT commands from the on-line transmitter.
- e) At each position, the ETVS shall allow simultaneous selection in any combination of the non-emergency frequency transmitters assigned to the position.

10.3.1.3.2. Main/standby (M/S) transmitter transfer.

Note: The FAA typically uses hot standby radio equipment for improved availability. Operators must be able to select between them.

- a) At each position, and for each frequency assigned to the position, the ETVS shall permit the operator to transfer between main and standby transmitters.
- b) The ETVS shall permit main/standby switchover to be initiated via a single touch action of an assigned latching selector.

- c) The ETVS shall make each successive transfer effective at all positions to which the affected frequency is assigned.
- d) Upon transfer from main to standby transmitter (or vice versa), the ETVS shall change the state of the appropriate M/S transfer circuit for the frequency.
- e) During active PTT, the ETVS shall inhibit M/S transfer of active transmitters.
- f) If a M/S selector is provided (i.e., as part of a standard selector set) by the ETVS for frequencies not having standby equipment, operation of this selector shall have no effect (i.e., not take transmitter off-line).

10.3.1.3.3. A/G PTT activation.

Whenever a PTT device (i.e., headset/handset [HS] PTT device, footswitch) is active at any position (hereafter “the transmitting position”), the ETVS:

- a) Shall provide a PTT activation signal to the transmit A/G frequency interface to activate the selected on-line transmitters (except emergency frequencies);
- b) Shall connect the operator microphone audio at the transmitting position to the selected transmitters;
- c) Shall not affect incoming A/G audio from frequencies having receiver selected but transmitter not selected;
- d) Shall inhibit all other operators from using both main and (if any) standby transmitters for the frequency in use;
- e) Shall route audio from the receivers associated with the active transmitters in accordance with the following:
 - 1) For frequencies designated by classmark for remote sidetone, route audio from the receivers to all operators having the frequency assigned and the receiver selected, and for “the transmitting position” only, attenuate the audio from all receivers by 12 dB; and if audio from any receiver designated for remote sidetone is selected to the LS by the per-frequency A/G HS/LS selector or any LS transfer feature at “the

transmitting position”, redirect this audio to the HS;

- 2) For frequencies designated for local sidetone, inject transmit audio from the transmitting operator into the receiver circuit, and route this audio to all operators having the frequency assigned and the receiver selected; and for “the transmitting position” only, attenuate the audio from all receivers by 12 dB; and if audio from any receiver designated for local sidetone is selected to the LS by the per-frequency A/G HS/LS selector or any LS transfer feature at “the transmitting position”, redirect this audio to the HS; and
- 3) For frequencies designated for PTT muting, mute the incoming audio;

Note: Local and remote sidetone options pertain to systems to be installed in DoD facilities; the PTT muting option pertains to FAA systems.

- f) Shall provide a continuous visual indication in accordance with 10.3.3.3.2 of transmitter-in-use for each active transmitter to all positions to which the frequency has been assigned (including the transmitting position, and regardless of whether the transmitter is selected or not); and,
- g) The ETVS shall resolve simultaneous PTT actuations for a frequency transmitter from local or remote positions such that only one position shall be connected to a frequency transmitter and all other positions shall be locked out.

10.3.1.3.4. A/G PTT lockout.

Note: This section describes management of contention for A/G frequencies.

- a) Whenever any operator not having preemption capability attempts to transmit on frequencies that are already in use by any other operator, the ETVS shall inhibit (lock out) the attempt.
- b) The ETVS shall provide distinct visual and audible indication of PTT lockout to the locked-out operator for the duration of the lockout; the audible indication shall not obscure communications in progress.
- c) The ETVS shall terminate the lockout upon release of PTT by either operator; it shall not be

necessary for a locked-out operator to release and reactivate PTT in order to acquire the transmitter.

- d) Frequencies not locked out shall continue to operate normally.

10.3.1.3.5. Emergency frequency transmitter activation.

Note: The intent of this section is to provide a “one-touch” activation capability for certain A/G frequencies.

- a) The ETVS shall, for all designated emergency frequencies (i.e., 121.5 MHz, 243.0 MHz), and for other frequencies designated by classmark, provide emergency frequency transmitter activation as described below.
- b) The ETVS shall permit the operator to initiate transmission on emergency frequencies with a single touch action of the appropriate non-latching emergency frequency transmitter selector.
- c) Whenever the transmitter selector is activated on an emergency frequency, the ETVS shall provide PTT and perform related actions in accordance with 10.3.1.3.3 (b) and following subparagraphs, without requiring activation of a separate PTT device (i.e., use of PTT from HS or footswitch shall not be required for transmission on emergency frequencies).
- d) Upon release of the emergency frequency transmitter selector, the ETVS shall terminate transmission on the frequency and associated lockouts.
- e) The selection of an emergency frequency transmitter shall not cause the activation of PTT on any other frequency.
- f) The ETVS shall permit simultaneous use of emergency and non emergency transmitters (i.e., by simultaneous activation of emergency transmitter selector and use of PTT device).
- g) The instructor must use the headset/handset PTT to preempt trainee audio on any emergency frequency, which will also key all radios selected for transmission at that position.

10.3.1.4. Receive controls.

10.3.1.4.1. Select/deselect receivers.

Note: "Selecting" a receiver enables audio from that receiver to be heard at the position via HS or LS.

- a) For each frequency (including emergency frequencies) at each position, the ETVS shall permit the operator to select and deselect the receiver associated with the frequency.
- b) The ETVS shall permit selection and deselection to be accomplished with a single touch action of a latching selector.
- c) At each position, the ETVS shall allow simultaneous selection in any combination of the receivers assigned to the position.
- d) The ETVS shall furnish incoming audio to the position HS or LS (depending upon selected routing per 10.3.3.15 for selected receivers, and shall withhold such audio for receivers not selected.
- e) If a M/S selector is provided (i.e., as part of a standard selector set) by the ETVS for frequencies not having standby equipment, operation of this selector shall have no effect (i.e., not take receiver off-line).

10.3.1.4.2. Main/standby receiver transfer.

- a) At each position, and for each frequency assigned to the position, the ETVS shall permit the operator to transfer between main and standby receivers.
- b) The ETVS shall permit main/standby switchover to be initiated via a single touch action of an assigned latching selector.
- c) The ETVS shall make each successive transfer effective at all positions to which the affected frequency is assigned.
- d) Upon transfer from main to standby receiver (or vice versa) the ETVS shall change the state of the appropriate M/S transfer circuit for the frequency.

10.3.1.4.3. Squelch break

- a) The ETVS shall provide a unique visual indication of the presence of audio on each A/G receiver circuit.
- b) The squelch break indication shall be derived from one of the following two sources, as identified by the government at time of order:
 - 1) Receipt of an appropriate squelch break signal from the remote radio control system;
 - 2) Detection by the ETVS of audio in accordance with 20.2.4.9.
- c) The ETVS shall sustain (hold over) the squelch break indication for a minimum of 2.5 seconds after the last incoming audio is detected.

10.3.1.5. Local preemption.

Note: Preemption means taking over and using a frequency regardless of whether others are using it at the time.

- a) For each frequency assigned to each position, the ETVS shall permit the position to be classmarked for local preemption on the frequency.
- b) Whenever the operator ("the preempting operator") activates PTT on frequencies over which the position has local preemption permission, the ETVS:
 - 1) Shall give control of the frequencies to the preempting operator;
 - 2) Shall terminate and lock out transmissions by any other operators not having local preemption permission;
 - 3) Shall lock out future transmissions by other operators (including those who also have local preemption permission) for the duration of the preempting operator's PTT; and,
 - 4) Shall distribute the preempting operator's outgoing audio to all positions, except the preempting position, having the frequency assigned and the receiver selected (unless the frequency is designated by classmark for either remote or local sidetone), as well as to the transmitter.

10.3.1.6. Remote frequency interlock.

Note: Remote frequency interlock permits two ATC facilities to share the use of one set of radio equipment, coordinating via an appropriate four wire E&M (or equivalent) trunk.

- a) The ETVS shall share access to designated A/G frequencies with other ATC facilities via a government furnished remote frequency interlock trunk for each such frequency (i.e., one frequency per trunk).
- b) For each remote frequency interlock trunk, the ETVS shall be classmarked either “interlocking” or “interlocked.”
- c) For remote frequency interlock trunks on which the ETVS is classmarked as interlocked, the ETVS:
 - 1) Shall permit the remote frequency interlock trunk to be assigned to vacant A/G frequency selectors at any or all positions;
 - 2) Shall permit the operator to select the remote frequency interlock trunk for transmission, reception, or both;
 - 3) Shall provide a unique visual indication of the presence of voice (i.e., squelch break indication) received from the trunk, regardless of whether the frequency has been selected;
 - 4) Shall provide a unique and continuous visual indication of the state of the interlock trunk transmitter (E-lead active indicates transmitter is in use by operators at the interlocking switch);
 - 5) Shall, whenever PTT is activated while the remote interlock trunk is selected and the interlock trunk E-lead is inactive, signal the interlocking switch by activating the M-lead on the remote interlock circuit; and,
 - 6) Shall, whenever PTT is activated while the remote interlock trunk is selected and the interlock trunk E-lead is active, lock out the attempt in accordance with 10.3.1.3.4.
- d) For remote interlock trunks for which the ETVS is classmarked as interlocking, the ETVS:

- 1) Shall connect the receive audio of the appropriate A/G receiver, in accordance with 80.3.1.4, to the transmit side of the remote interlock trunk transmit interface;
- 2) Shall, whenever the A/G transmitter PTT is active, activate the M-lead on the remote frequency interlock trunk;
- 3) Shall, whenever the E-lead is active on the interlock trunk and the transmitter is not in use by a local user, connect the receive audio from the interlock trunk to the appropriate A/G transmitter, activate PTT for that transmitter, and provide PTT lockout (per 10.3.1.3.4) to local users (i.e., positions of the interlocking switch);
- 4) Shall, whenever the E-lead is active on the remote frequency interlock trunk and the transmitter is in use (PTT active) by a local user, permit the local user to continue transmitting and take no action regarding the interlock trunk; and,
- 5) Shall discontinue access for remote interlock upon entry of a supervisory command.

10.3.1.7. Remote preemption.

Note: Remote preemption is similar to remote frequency interlock except that operators at one of the two facilities can preempt communications on the frequency by operators at the other facility.

- a) The ETVS shall share access to designated A/G frequencies with other ATC facilities via a government-furnished remote preemption trunk for each such frequency (i.e., one frequency per trunk).
- b) For each remote preemption trunk, the ETVS shall be classmarked either “preempting” (special user having preemption privileges) or “nonpreempting” (normal user subject to preemption).
- c) For remote preemption trunks on which the ETVS is classmarked as preempting, the ETVS:
 - 1) Shall permit the trunk to be assigned to vacant A/G frequency selectors at any or all positions;

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| <ul style="list-style-type: none">2) Shall permit the operator to select the trunk for transmission or reception or both;3) Shall provide a visual indication of the presence of voice (i.e., squelch break indication) received from the trunk, regardless of whether the frequency has been selected; and,4) Shall signal the nonpreempting switch by activating the M-lead on the remote preemption trunk whenever PTT is activated while the remote preemption trunk is selected for transmission. <p>d) For remote preemption trunks on which the ETVS is classmarked as nonpreempting, the ETVS:</p> <ul style="list-style-type: none">1) Shall combine transmit audio and receive audio, in accordance with 80.3.1.4, for the frequency and transmit to the preempting facility via the remote preemption trunk at all times except when the external system is preempting;2) Shall connect the receive channel of the remote preemption trunk to the appropriate A/G transmitter and activate PTT for this transmitter whenever the E-lead is activated on the remote preemption trunk;3) If the A/G transmitter is in use by a local user and the E-lead is active, shall disconnect the local operator from the transmitter and provide PTT lockout, in accordance with 10.3.1.3.4, to the local operator;4) Shall, whenever the E-lead is activated on the remote preemption trunk, provide the audio received from the remote preemption trunk to all local users who have selected the frequency for reception; and,5) Shall discontinue access for remote preemption upon entry of a supervisory command. | <ul style="list-style-type: none">1) Activation of a direct access selector (if any) assigned to the call or circuit; or,2) Entry of a code assigned to the IP circuit (or IC call) via the IA keypad. <p>b) Upon placement of a call of any type identified below, the ETVS shall take the indicated steps to connect the call to its destination:</p> <ul style="list-style-type: none">1) For an IC call, ring the call at the called position;2) For an IC OVR call, connect the call in accordance with 10.3.2.2.3; and,3) For non-IC calls, provide outgoing call signaling to the trunk or circuit interface appropriate to the type of trunk or circuit and the type of call in accordance with Appendix F. <p>c) Whenever the operator seizes a circuit of a type that requires or permits additional dialing for call routing or other purposes, the ETVS:</p> <ul style="list-style-type: none">1) Shall permit the operator to enter additional digits at the IA keypad; and,2) Shall provide such digits to the circuit interface in the format appropriate to the circuit (e.g., SS-4 tone burst, DTMF tone burst, dial pulse train). <p>d) Whenever the operator seizes a circuit of a type that permits manual ring or re-ring, the ETVS shall permit the operator to operate the manual ring DA selector in accordance with 10.3.2.7.7.</p> <p>e) Whenever the operator seizes a circuit of a type that permits hook flash signaling for the operation of special functions on external networks and systems, the ETVS shall permit the operator to operate the hook flash selector in accordance with 10.3.2.7.6.</p> |
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10.3.2. Ground-to-ground communications.

10.3.2.1. G/G call placement.

- a) The ETVS shall permit the operator to place a G/G call by either of the following means:

10.3.2.2. Incoming G/G call alerting.

10.3.2.2.1. IC call.

- a) Upon receipt of a non-OVR call from another position, the ETVS:

- 1) Shall provide incoming call chime at the called position when chime control has been activated;
 - 2) Shall provide visual indication of incoming call at the DA selector assigned to the calling party or to the CA selector if no DA selector is provided; and,
 - 3) Shall provide ringback tone to the calling party.
- b) The ETVS shall discontinue the audio and visual indications established in (a) above when the call is answered by the called party (10.3.2.3) or is abandoned by the calling party (10.3.2.4).
- c) The ETVS shall not remove the incoming chime until the last incoming G/G call to the position has been either answered or abandoned.

10.3.2.2.2. Voice call.

Note: A voice call circuit is a dedicated “hot line” that uses voice alerting (“hoot ‘n holler”) instead of ringing to alert the called party.

- a) Upon detection of incoming audio on a voice call circuit interface, and at each position to which a DA selector has been assigned for the circuit, the ETVS:
- 1) Shall provide a visual indication of incoming call at the DA selector assigned for the circuit; and,
 - 2) Shall direct the incoming audio from the circuit to the position LS at each position classmarked for incoming voice alert on the circuit.
- b) If the voice call has not been answered and 15 seconds have elapsed without detection of further audio on the circuit, the ETVS shall remove the visual indication and audio connection established in (a) above.

10.3.2.2.3. Override call.

Note: An override call is a high priority call that is connected to the called party automatically, joining the called party’s calls in progress.

Upon detection of appropriate incoming call signaling on an IP OVR circuit, or upon receipt of an IC OVR

call from another position, the ETVS, at the called position:

- a) Shall provide visual indication of active incoming OVR call at the DA selector assigned to the calling party (if any) or to the IA OVR indicator;
- b) Shall immediately connect the incoming OVR call to the called party such that the override hears all calls to the overridden party, including A/G communications, without disconnecting any calls in progress at the called position, and regardless of the number of OVR calls that may be in progress;
- c) Shall provide a momentary audible indication of override to all positions and G/G IP circuits involved in the override conference, including the incoming OVR caller. The indication shall not be so loud or lengthy as to obscure communications in progress; and,
- d) Shall suppress the effects of oscillation, distortion, or level misregulation that might arise from OVR call chaining (e.g., party A overrides party B who is overriding party C, etc.).

10.3.2.2.4. Selective IP calls.

Note: Selective calls employ address signaling (e.g., SS-4) to identify the called party or parties.

Upon detection of appropriate incoming call address signaling from an IP circuit interface configured for selective calling, the ETVS:

- a) Shall accept and decode the call address;
- b) Shall determine whether the address information refers to any local ETVS positions or groups of positions.;
- c) Shall provide visual indication of incoming call at each position to which the call address refers, either at the DA selector (if any) assigned to the IP circuit, or at the CA selector;
- d) Shall activate incoming call chime at each position to which the call address refers, and at which call chime control has been activated by the position operator, and for which the circuit has been classmarked to receive incoming call chime; and,
- e) Shall discontinue the chime and visual indication established in (c) and (d) above when:

- 1) The call is answered by a position (10.3.2.3); or,
- 2) The call has not been answered by any position after 30 seconds; or,
- 3) Any address digit has been received on the SS interface.

10.3.2.2.5. IP inward dial calls.

Note: These calls are typically switched calls placed via the public network or government networks, or via local government furnished local exchange equipment (e.g., PABX).

Upon detection of appropriate incoming call address signaling from an IP circuit configured for incoming dial, the ETVS:

- a) Shall accept and decode the call address;
- b) Shall determine whether the address information refers to any local ETVS positions or groups of positions;
- c) Shall provide visual indication of incoming call at each position to which the call address refers, either at the DA selector (if any) assigned to the IP circuit, or at the CA selector;
- d) Shall activate incoming call chime at each position to which the call address refers, and at which call chime has been activated by position operator, and for which the circuit has been classmarked to receive incoming call chime;
- e) Shall provide ringback tone to the IP circuit; and,
- f) Shall discontinue the visual indication in (c), chime in (d), and ringback tone in (e) when:
 - 1) The call is answered by a position (10.3.2.3); or,
 - 2) The call is abandoned by the calling party (10.3.2.4).

10.3.2.2.6. IP non-selective.

- a) Upon detection of an appropriate incoming seize from the IP circuit classmarked for non-selective service, including automatic or manual ring (re-ring), the ETVS:

- 1) Shall provide visual indication of incoming call at each position to which the call refers, either at the DA selector (if any) assigned to the IP circuit, or at the CA selector;
- 2) Shall activate incoming call chime at each position to which the call refers, and at which call chime has been activated by position operator, and for which the circuit has been classmarked to receive incoming call chime; and,
- 3) Shall provide ringback tone to the IP circuit.

- b) The ETVS shall discontinue the visual indication, chime, and ringback tone established in (a) above when:

- 1) The call is answered by a position (10.3.2.3); or,
- 2) The call is abandoned by the calling party (10.3.2.4).

10.3.2.3. Incoming G/G call answering.

- a) The ETVS shall permit the operator to answer incoming G/G calls by any of the following means:
 - 1) Activation of the DA selector assigned to the circuit (or IC call) if any;
 - 2) Entry of a code assigned to the circuit or call via the IA keypad; or,
 - 3) Activation of the CA selector if the call is specifically directed to the called position but no DA for the calling position or circuit has been assigned.
- b) Upon answering of an incoming non-OVR call, the ETVS:
 - 1) Shall connect the answering operator with the calling position (for IC calls) or the trunk/circuit interface bearing the incoming call (for non-IC calls);
 - 2) Shall discontinue incoming call chime or voice alert, if any, for the current call (i.e., chime to be continued if other unanswered incoming calls are present) at all positions having a DA selector assigned to the call;

- 3) Shall, at the answering position (and the calling position for IC calls), provide visual indication of active call at the DA selectors assigned to the call (if any) or to the CA selector if the call does not have a DA assigned to the other party; and,
 - 4) For all IP G/G calls, shall, at all other positions having a DA selector assigned to the circuit, provide visual indication of busy call at the DA selectors.
- c) The ETVS shall require no operator action to answer an incoming OVR call (i.e., the call is automatically connected without action from the called party).

10.3.2.4. G/G call release and termination.

- a) The ETVS shall permit the operator to release G/G calls in progress (i.e., not on hold), except for OVR calls in which the operator is the called party, by any of the following methods:
 - 1) Placement of another call via IA or DA (except during progressive conferences);
 - 2) Deselection of the DA selector assigned to the call if the call appears as a DA call;
 - 3) Selection of a designated call release DA selector; or,
 - 4) If the call appears as an incoming IA call, deselection of the CA selector.
- b) The ETVS shall permit the operator to release incoming OVR calls in progress only by entry of an assigned IA code.

Note: Incoming IP OVR calls must be restricted to circuits having positive call termination signaling.

- c) The ETVS shall release any non-IC calls in progress whenever appropriate call termination signaling is received from the trunk/circuit interface bearing the call.
- d) If the trunk or circuit bearing an active call is of a type that does not provide call termination signaling, the ETVS shall not release the call until the local operator performs one of the actions listed in (a) above.
- e) Reserved.

- f) Upon call release, the ETVS:
 - 1) Shall discontinue audio transmission between the called and calling parties (for IC calls), or the local party and the trunk/circuit interface (for non-IC calls); and,
 - 2) Shall discontinue visual indications of active call (at the called and/or calling positions), busy call (at all other positions having a DA assigned).

10.3.2.5. G/G IP circuit conferencing.

- a) Upon each attempt to access a trunk, public address interface, or circuit that is in use, and that has been designated private by classmark, the ETVS shall reject the call attempt and provide busy tone to the attempting position.
- b) Upon each attempt to access a trunk or circuit that is in use, and that has not been designated private by classmark, the ETVS:
 - 1) Shall immediately connect the attempting operator to the circuit such that the attempting operator can hear all other parties on the circuit, and be heard by them;
 - 2) Shall provide visual indication of active call at the attempting position, either at the DA selector assigned to the call (if any), or at the IA selector;
 - 3) Shall permit at least 6 operators to join into the trunk or circuit (not to be counted as a conference call per 10.3.2.7.2); and,
 - 4) Shall provide a busy tone to any party attempting to access the trunk or circuit in excess of the ETVS's ability to provide simultaneous correction.

10.3.2.6. Use of PTT in G/G communications.

The ETVS shall provide two options, one or the other selectable by classmark during mission reconfiguration, for the use of PTT in G/G communications:

- a) Under option #1, allow operator to transmit on G/G calls without activating PTT.

- b) Under option #2, require operator to activate PTT in order to transmit on G/G communications

Note: Generally option 2 would be used for positions that have no A/G assignments; option 1 would be used for other positions. Option 2 is intended to reduce the number of inadvertent "hot MIC" conditions.

10.3.2.7. G/G call features.

10.3.2.7.1. Call hold.

- a) At each position, the ETVS shall permit the operator (hereafter referred to as "the operator initiating the hold") to put the active G/G call on hold upon activation of a designated DA selector.
- b) The ETVS shall permit all types of G/G calls to be placed on hold except for OVR calls in which the initiating operator is the called party, and calls on circuits that do not provide appropriate call disconnect signaling.
- c) During call hold, the ETVS shall not transmit audio between the parties on hold and the operator initiating the hold.
- d) During call hold, the ETVS shall permit the initiating operator to place A/G calls and other G/G calls as if no G/G call were active.
- e) For each call on hold, the ETVS shall provide a visual indication of call-on-hold to:
- 1) The DA selector (if any) at each position assigned to the call on hold;
 - 2) The IA selector of the initiating position (if the call on hold was placed as an IA call); and,
 - 3) The CA selector of the position initiating the hold if the call on hold was answered with the CA selector.
- f) Upon receipt of appropriate call disconnect signaling from the trunk/circuit interface bearing a call on hold, the ETVS shall release the call and end the holding state.
- g) The ETVS shall permit the operator at any position to retrieve any non-IC call on hold by seizing the circuit via IA (or DA, if assigned) regardless of which ETVS operator originally placed the call on hold.

Note: this requirement represents an implicit call transfer function, as would be provided on a key telephone system. The operator who answers the call can place it on hold and notify the intended called party, who can then retrieve the call at his or her own position.

- h) Upon retrieval of a call on hold, the ETVS shall restore the call audio and the visual indication of active call (to be provided at the retrieving position) and busy call (to be provide at all other positions having a DA selector assigned to the call).
- i) The ETVS shall maintain calls on hold until they are retrieved or released, whichever comes first.

10.3.2.7.2. Conference calling.

- a) The ETVS shall permit the position operator to establish conference calls with IC and IP parties.
- b) The ETVS shall support at least 3 conferences simultaneously, each accommodating at least six parties (including the originator) from among the following:
- 1) Any other position (via IC); and,
 - 2) Any party connected by IP G/G circuit having supervision.
- c) The ETVS shall connect all conference participants to enable them to converse with each other.
- d) The ETVS shall permit the conference originator to add and release individual conference participants progressively (one at a time).
- e) The ETVS shall permit the conference originator to release all conference participants at once with a single touch action (terminating the conference call).
- f) Upon addition of each new party to a conference call, the ETVS shall provide a momentary audible indication to all positions and IP G/G circuits participating in the conference.
- g) Throughout each conference call, the ETVS shall provide a visual indication of active call at the conference call selector of the originating position.

- h) The ETVS shall permit local conference participants to place the conference on hold, which shall have the effect of removing the participant from the conference temporarily without releasing the conference, such that all remaining conference participants may continue to converse.
- i) The ETVS shall permit conference participants other than the originator to release from the conference call, which shall have the effect of terminating the releasing party's participation only (i.e., other participants may continue with the conference call), by the following means:
 - 1) For participants (local to the ETVS) connected via IC, through applicable call release procedures; and,
 - 2) For participants (external to the ETVS) connected via external G/G circuits, through call termination signaling provided by the circuit.
- j) The ETVS shall permit supervisory personnel to define preset conference calls as classmarks within the mission configuration map.
- k) The ETVS shall permit supervisory personnel to assign DAs to appropriate positions for access to each preset conference call.
- l) Upon activation of the DA for any preset conference, the ETVS shall ring all preset conference participants (other than the originator) following the procedures appropriate for each type of call (e.g., IC for other positions, IP for remote parties).
- d) While call forwarding is in effect at any position, and during calls that imply direct or indirect connectivity from the forwarded-to position to the forwarding position (e.g., preset conference calls in which both parties are normally participants) the ETVS shall prevent audio distortion or oscillation due to such connectivity by either of the following means:
 - 1) Blocking such connectivity; or,
 - 2) Conditioning or regulating the audio resulting from such connectivity so that distortion and oscillation are not present.
- e) The ETVS shall permit (only) the forwarded-to position operator to release call forwarding by an appropriate control action.
- f) The ETVS shall discontinue the attempt and provide an error indication to the position attempting to forward calls whenever the attempt cannot be completed due to any of the following:
 - 1) error in entry,
 - 2) forwarded to position will have more than 10 positions forwarded to it, or
 - 3) forwarded to position has call forwarding in effect already.
- g) The ETVS shall permit any position to forward its own calls while it has calls forwarded to it from any other position.
- h) During call forwarding at any position, the ETVS shall permit operators to place outgoing calls from the forwarding position (e.g., for coordination to terminate call forwarding).

10.3.2.7.3. Call forwarding.

- a) The ETVS shall provide a call forwarding function which, upon activation, and selection of a forwarded-to position, shall cause all subsequent G/G calls destined for the forwarding position to be forwarded to the selected position.
- b) The ETVS shall permit the call forwarding function to be activated by entry of an appropriate IA code, or by activation of a DA assigned for the purpose.
- c) The ETVS shall provide a visual indication at the forwarding position whenever call forwarding is in effect.

10.3.2.7.4. Monitoring of other positions.

- a) The ETVS shall permit each operator to monitor at least any three other position at a time.
- b) The ETVS shall permit each supervisor to monitor at least any three other positions at a time.
- c) The monitoring shall include all audio from the monitored position's HS jack, and all audio to the position's HS jack and LS.
- d) The monitoring shall be accessible by IA or DA.

- e) The ETVS shall give no indication to monitored positions that they are being monitored.
- f) The ETVS shall permit the supervisor to activate a privacy feature whereby supervisory position audio cannot be monitored or recorded by other operators (except for legal voice recording).
- g) During monitoring, at the monitoring position, the ETVS shall provide a distinct visual indication that monitoring is in progress.
- h) Upon connection by the monitoring position to any G/G call (by IA or DA call placement, by IA or DA call answering, but not during connection to an incoming IC OVR call), or placement (by activation of PTT) of any A/G call, the ETVS, throughout the second call:
 - 1) Shall mute the monitored audio to the monitoring position; and,
 - 2) Shall provide visual indication that monitoring is on hold.
- i) Upon release of any G/G call or PTT at the monitoring position during position monitoring, the ETVS shall resume position monitoring as previously established.
- j) Whenever monitoring is active at any position, the ETVS shall route any incoming A/G calls intended for that position in accordance with 10.3.3.15.
- d) The ETVS shall provide visual indication at the position whenever the chime has been turned off, independent of the visual indications provided for incoming calls.
- e) The ETVS shall provide means for the operator at each position to adjust individually the volume of the chime, independent of other volume levels, subject to the limitation that the chime never be adjustable so low as to produce less than 55 dBSPL at a distance of one meter on-axis with a background noise of 45 dBa.
- f) The ETVS shall not sound chime through the HS.
- g) The ETVS shall not record chime on the legal voice recorder.

10.3.2.7.6. Hook flash.

- a) At each position designated by classmark, the ETVS shall provide a non-latching DA selector for hook flash which, when activated, provides an appropriate hook flash signal to the trunk/circuit interface bearing the G/G call in progress (typically for access to special features of an external government-furnished telephone exchange).
- b) The hook flash selector shall have no effect if activated:
 - 1) During a call borne by a trunk or circuit that does not accept hook flash signaling, or,
 - 2) While no G/G calls are in progress.

10.3.2.7.7. Manual ringdown.

- a) At each position designated by classmark, the ETVS shall provide a non-latching DA selector for re-ring which, when activated, provides an appropriate re-ring signal to the trunk/circuit interface bearing the G/G call in progress (typically for re-ring of ringdown calls).
- b) The re-ring selector shall have no effect if activated;
 - 1) During a call borne by a trunk or circuit that does not accept manual ringdown signaling; or,
 - 2) While no G/G calls are in progress.

Note: this feature may be used by controllers to listen in on each other for training/coordination purposes, or by supervisors for personnel evaluation purposes.

10.3.2.7.5. Incoming call chime.

- a) The ETVS shall provide an audible chime device to each position (sounded at the position equipment) to alert the operator of incoming G/G calls.
- b) The ETVS shall provide at least four choices of chime tone character, selectable by the operator, or by the supervisor via supervisory position input, such that each position may have an identifiably different chime tone from those of other positions in the vicinity.
- c) The ETVS shall permit the operator to turn the chime on and off at each position.

10.3.2.7.8. A/G-G/G coupling.

Note: A/G-G/G coupling will permit G/G callers to hear both sides of A/G calls; this feature will be most useful in law enforcement actions and incident investigations.

- a) The A/G-G/G coupling feature shall be available regardless of which receiver audio routing option (paragraph 80.3.1.4) is selected for the radio interface involved in the A/G-G/G coupling.
- b) At each position, as designated by classmark, the ETVS shall assign a DA selector for A/G-G/G coupling.
- c) Upon activation of the A/G-G/G coupling selector, or entry of an appropriate IA code for A/G-G/G Coupling, the ETVS:
 - 1) Shall route incoming audio from all A/G receivers selected at the position to any G/G calls (including conference calls) active at the position;
 - 2) While PTT is active at any position in the ETVS, on the A/G frequency involved in the A/G-G/G coupling, shall route the outgoing audio for that frequency to any G/G calls (including conference calls) active at the position;
 - 3) While A/G-G/G coupling is active, shall allow the initiating position to disable and enable radios (Tx, Rx and M/S), including radios selected at the time coupling was initiated, to alter selection of coupled radios; and
 - 4) Shall provide a visual indication of active call at the A/G-G/G coupling selector.
- d) Upon deactivation of the A/G-G/G coupling selector, the ETVS shall withhold A/G receiver audio from the G/G calls and extinguish the A/G-G/G coupling active indication.
- e) In no case shall the ETVS, as a result of A/G-G/G coupling being engaged, transmit audio from the G/G call over A/G frequencies.

10.3.2.7.9. Public address.

- a) As ordered by the government, the ETVS shall connect to a government-furnished public address service within the ATC facility.

- b) At each position, as designated by classmark, the ETVS shall provide a selector for public address.
- c) Upon activation of the public address selector (or entry of an appropriate IA code assigned to the voice paging interface), and until an appropriate call release action is taken, the ETVS shall connect the operator to the public address system interface.

10.3.2.7.10. Speed dial.

- a) The ETVS shall provide speed dial to at least 30 DA selectors at each position.
- b) The ETVS shall assign up to at least 20 alphanumeric characters (including the “#” and “*” characters) to each speed dial selector.

10.3.2.8. Simultaneous G/G and A/G calls.

- a) Under facility PTT option 1 (see 10.3.2.6), the ETVS shall permit each operator to place and receive A/G calls at any time during any G/G call without interrupting the G/G call.
- b) The ETVS shall not furnish audio received from A/G frequencies to the external party (of the G/G call in progress) except when the external party has placed an OVR call to the position, or when A/G-G/G coupling is in effect at the position.
- c) The ETVS shall continue to furnish G/G call audio (transmitted and received) during the receipt of A/G audio call such that the external party and the operator continue to hear each other.
- d) In no case shall the ETVS send audio from the G/G caller over A/G frequencies.

10.3.3. Operational position controls and access selectors.

10.3.3.1.1. Functions of DA selectors.

At each position, the ETVS shall provide direct access selectors that may be assigned to any of the following functions:

- a) Placement of IC calls;
- b) Seizure of external circuits for IP or other external G/G calls; or,

- c) Activation of special functions.

- 2) Inactive (function not active); and,

10.3.3.1.2. DA selector identification.

- a) Each DA selector shall be capable of displaying at least seven alphanumeric characters.
- b) DA selector displays used in tower cab position equipment shall be programmable electronically (i.e., as a result of mission reconfiguration) or else through maintenance action (e.g., replacement of keycap legend).
- c) DA selector displays used elsewhere (e.g., in approach positions) shall be programmable electronically (i.e., as a result of mission reconfiguration).
- d) Whenever a function of a DA selector having an electronically-programmable display is changed (i.e., through mission reconfiguration), the ETVS shall automatically change the associated display to reflect the new function.
- e) DA selectors having electronically programmable displays but no current assignment shall be blank or shall not be displayed.

10.3.3.1.3. DA selector visual displays.

- a) ETVS DA selectors assigned for the placement of G/G calls (including IC calls) shall provide continuous and unique visual indication of the state of their assigned calls, trunks, or circuits, from among the following:
 - 1) Idle (no call in progress);
 - 2) Ringing (incoming call is not yet connected);
 - 3) Active (incoming call is connected or outgoing call has been placed);
 - 4) Busy (call in progress at another position, not to be used for IC DAs); and,
 - 5) Hold (call is on hold).
- b) ETVS DA selectors assigned for the activation of special functions shall provide continuous and unique visual indication of the state of their assigned function, from among the following:
 - 1) Active (function active);

- 3) Pending (function in transition between active and inactive).

10.3.3.1.4. Latching of DA selectors.

The ETVS shall permit each DA selector to be assigned to be latching or non-latching, as defined below, and unless such choice is excluded elsewhere in this specification:

- a) Latching selector requires only one momentary touch action to transit between active and inactive states; and,
- b) Non-latching selector requires continuous touch pressure to remain in the active state.

10.3.3.2. IA keypad.

10.3.3.2.1. IA keypad layout.

At each position, the ETVS shall provide an IA keypad consisting of the following at a minimum:

- a) A telephone keypad or electronic emulation thereof, marked and arranged as shown in Figure 10-1, with approximate key dimension of 1/2 inch, for the purpose of entering call address digits and other data;

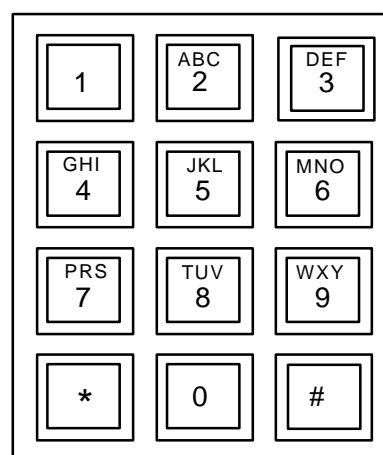


Figure 10-1. Telephone keypad layout

- b) An IA selector for the purpose of initiating IA calls;

- c) A call release selector for the purpose of releasing IA and DA calls;
- d) An alphanumeric display with sufficient capacity to display the data required by this specification;
- e) A common answer (CA) selector for the purpose of answering calls; and,
- f) An incoming IA OVR call indicator.

10.3.3.2.2. Placement and answering of G/G calls using IA keypad.

- a) The ETVS shall permit the operator to place an IA IC call to any other position by:
 - 1) Activation of IA selector; and,
 - 2) Entry at telephone keypad of address digits assigned to the called position, plus code for OVR call if appropriate.
- b) The ETVS shall permit the operator to seize any available IP, voice call, outgoing trunk group, or external network trunk (i.e., that does not have privacy feature, is not out of service, and has not been restricted against use by the position) by:
 - 1) Activation of IA selector;
 - 2) Entry at telephone keypad of address digits assigned for access to the trunk.
- c) The ETVS shall permit the operator to answer incoming calls that have no DA assigned (i.e., that appear as incoming IA calls) by activating the CA selector.
- d) The ETVS shall permit the operator to enter additional digits at the IA keypad after a call has been connected or circuit has been seized (e.g., to dial numbers on external circuits or to use phone menu systems). In each case, the ETVS shall provide the digits to the trunk/circuit interface according to the appropriate dialing protocol (i.e. dual-tone multi frequency [DTMF], pulse dialing, SS-4) of the selected IP or external network circuit.

10.3.3.2.3. IA keypad visual displays.

- a) When the IA keypad is used for G/G communications, the IA selector and CA selector shall provide a continuous and unique visual

indication of the state of such communications, from among the following:

- 1) Idle (no call in progress);
- 2) Ringing (incoming call is not yet connected);
- 3) Active (incoming call is connected or outgoing call has been placed); and,
- 4) Hold (call is on hold).

- b) When the IA keypad is used for the entry of data not directly involved with G/G communications (e.g., management information system logon), the IA keypad shall provide a continuous and unique visual indication of the state of such data entry, from among the following:

- 1) Accepting data (waiting for user to enter digits);
- 2) Not accepting data (any digits entered will be ignored);
- 3) Error (user has entered an invalid digit or sequence of digits).

- c) The IA keypad shall display digits entered by the operator. This display shall be maintained until call release (if the data entry pertains to a G/G call), or until the end of data entry (if the data entry pertains to special functions such as the MIS logon).

- d) The IA keypad shall display when an incoming IA call is an OVR call.

10.3.3.2.4. IA keypad entry error warning.

Whenever the operator enters an unassigned dial code at the IA device (i.e., one that does not result in a valid call or circuit seizure, or activate any special feature), the ETVS shall provide an audible indication of erroneous input (e.g., reorder tone).

10.3.3.2.5. IA call management.

The ETVS shall permit each position to have at least one active IA call at a time.

10.3.3.2.6. Caller identity display.

- a) For incoming calls on private lines that provide caller identity information (e.g., FAA type 20 trunks), the ETVS shall decode this information and display it at the IA display, even if call appears as a DA.
- b) For each call answered with CA, the ETVS shall display the identify of that position (for IC calls) or G/G circuit (for IP calls).

10.3.3.3. A/G frequency controls.

10.3.3.3.1. A/G frequency control layout.

For each A/G frequency assigned to a position, the ETVS shall provide a suite of controls and displays including the following:

- a) Transmitter select/deselect selector;
- b) Transmitter main/standby selector;
- c) Receiver select/deselect selector;
- d) Receiver main/standby selector; and,
- e) Per-frequency HS/LS routing selector.

10.3.3.3.2. A/G control displays.

- a) Each transmitter selector shall provide a continuous and unique indication of the state of its assigned frequency transmit function, from among the following:
 - 1) Transmitter not selected and idle (operator has not selected frequency and no one is transmitting on it);
 - 2) Transmitter not selected and busy (operator has not selected transmitter, and someone else is transmitting on it);
 - 3) Transmitter selected and idle (operator has selected transmitter, and no one is transmitting on it);
 - 4) Transmitter selected and active (operator has selected transmitter, and is transmitting on it);

- 5) Transmitter selected and busy (operator has selected transmitter but someone else is transmitting on it); and,
 - 6) Transmitter locked out (operator has selected transmitter and is attempting to transmit, but has been locked out by another operator).
- b) Each receiver selector shall provide a continuous and unique indication of the state of its assigned frequency receiver function, from among the following:
 - 1) Receiver not selected and idle (operator has not selected receiver and no audio is detected);
 - 2) Receiver not selected and active (operator has not selected receiver, and audio squelch break is detected);
 - 3) Receiver selected and idle (operator has selected receiver, and no audio is detected); and,
 - 4) Receiver selected and active (operator has selected receiver, and audio squelch break is detected).
 - c) Each main/standby selector shall provide a continuous and unique indication of the state of its assigned receiver or transmitter, from among the following:
 - 1) Main selected;
 - 2) Standby selected.
 - d) Each per-frequency A/G HS/LS selector shall provide a continuous and unique indication of its state, from among the following:
 - 1) HS routing selected;
 - 2) LS routing selected.
 - e) The display provided at each A/G HS/LS selector shall reflect the actual routing in effect, which may be affected by functions other than the selector (e.g., automatic transfer, unattended position).

10.3.3.3.3. A/G frequency displays

- a) Immediately adjacent to each set of A/G frequency control selectors at each position, the ETVS shall

provide a display of the frequency of the radio equipment to which the selectors have been assigned.

- b) The frequency display shall be capable of showing up to 7 alphanumeric characters to represent the frequency in megahertz (or other identifier) of the equipment.
- c) Whenever the assignment of a set of A/G frequency selectors is changed, the ETVS shall permit the frequency display to be easily changed to reflect current configuration.
- d) The ETVS shall automatically update the frequency display for equipment provided with electronically programmable displays whenever the assignment of A/G frequency selectors is changed.

10.3.3.4. HS jack modules.

- a) At each position, the ETVS shall provide a jack module to accommodate two headsets or handsets (two operators).
- b) One jack shall be identified and marked as the “trainee” jack, and the other shall be identified and marked as the “instructor jack”.
- c) The instructor jack shall be placed immediately to the left of the trainee jack.
- d) The ETVS shall allow either jack to be used for all communications features.
- e) Upon insertion of HS devices into both jacks of the dual jack set, the ETVS shall route all HS audio transmitted to the position to both HS devices.
- f) The ETVS shall route trainee transmit audio (i.e., when the trainee HS microphone is hot) to the instructor HS device for monitoring purposes, unless the trainee PTT is active and 1 or more frequencies designated by classmark for either remote or local sidetone is selected for transmit at the position.
- g) The ETVS shall permit an HS device connected to the instructor jack to preempt A/G communications at the trainee jack by activation of PTT.
- h) During preemption, the ETVS shall provide the preempting instructor jack transmit audio to the trainee HS device for monitoring purposes, unless

1 or more frequencies designated by classmark for either remote or local sidetone is selected for transmit at the position.

- i) For each G/G call when PTT option 1 is in effect (see 10.3.2.6), the ETVS shall make both HS devices audible on the call and shall furnish call audio, including sidetone, to both HS devices.
- j) The jack modules shall be installed in the location specified at time of order.

10.3.3.5. HS volume controls.

- a) The ETVS shall provide a separate volume control for each HS jack, located in a convenient location for use by the position operator.
- b) The HS volume control shall adjust the audio output level over a range of +16 to -15 dB relative to the transmission level defined for the HS output jack.

Note: During acceptance testing, the volume control must be capable of being adjusted to make the HS a -16 TL as required in the uniform analog transmission plan, and must also be capable of being adjusted about this point by the range indicated above.

10.3.3.6. HS jack volume limiter.

- a) As a means to protect operators’ hearing, the ETVS shall provide audio compression circuitry located after any operator volume control setting, and as close to the HS jack as electrically possible, having the following characteristics:
 - 1) At a frequency of 1 KHz and for any audio level into the limiting circuit in excess of -20 dBm, reduce the level of the signal going to the HS jack to -20 dBm \pm 1 dB in 10 ms or less (i.e., attack time);
 - 2) For any frequency less than 1 KHz into the limiting circuit having an amplitude from 6 to 8 dB per octave higher than the level at 1 KHz, reduce the level of the signal going to the HS jack to a level 6 to 8 dB per octave higher than the level at 1 KHz in 10 ms or less.
 - 3) For any frequency above 1 KHz into the limiting circuit, reduce the level of the signal going to the HS jack to -20 dBm \pm 3 dB in 10 ms or less.

- 4) For any received signal into the limiting circuit going from a level in excess of the limit level for the frequency of the received signal to a level at or below the limit level, suspend all signal reduction invoked in (1), (2) or (3) above within 450 ± 150 ms (i.e., release time).
- b) The ETVS shall absolutely limit any signal into each HS jack to no more than -7 dBm ± 1 dB, regardless of input level.

10.3.3.7. Sidetone.

Note: "Sidetone" is the provision of the talker's audio into the earpiece of the talker's HS as an aural cue that transmission is underway. Thus, it is not desirable in circumstances under which the operator is not transmitting (i.e., no call active).

- a) The ETVS shall provide individual sidetone to each HS earpiece jack during active G/G calls, outgoing A/G calls unless 1 or more of the active frequencies is designated by classmark for either remote or local sidetone, and relief briefings, and shall refrain from providing sidetone otherwise.
- b) The ETVS shall provide each HS jack with a separate sidetone level adjustment.
- c) The sidetone level adjuster shall permit the operator to adjust the sidetone level between 16 and 24 dB below the audio level provided at the position HS microphone.
- d) Sidetone shall not be audible in the LS.
- e) Sidetone shall not contain anything other than outgoing call audio (i.e., the operator's voice).

10.3.3.8. Position loudspeakers.

- a) The ETVS shall provide each position with a separate loudspeaker.
- b) The loudspeaker element shall be of sufficient size and power rating to produce a sustained sound pressure level of 88 dB SPL at a distance of one meter on-axis, when driven by a 1004-Hz test tone and baffled as for installation in the ATC facility console.

Note: This requirement pertains only to the size and power dissipation ability of the individual loudspeaker elements, and not to their performance within the ETVS. Audibility of the LS in its ETVS installation is covered below.

- c) The ETVS shall provide each LS with a separate volume control, adjacent to the LS, or in another convenient location for use by the position operator.
- d) At the minimum setting of the volume control, the loudspeaker element shall produce 55 dB SPL at a distance of one meter on-axis, when driven by a -11.6 dBm 1004 Hz test tone.
- e) At the maximum setting of the volume control, when driven by input signals encountered in normal use, the ETVS shall be audible within at least 8 feet of the position, and shall not overdrive the LS so as to produce audible distortion or clipping.

10.3.3.9. Footswitch operation.

- a) As identified at time of order, each operational position shall be provided with a removable pedal-type footswitch for activation of PTT.
- b) When only one HS device is plugged into the operational position (either trainee or instructor jack), the ETVS shall permit the footswitch to be used as an alternate PTT device, i.e., in parallel with the HS PTT device.
- c) When one HS device is plugged into the instructor jack of the operational position, and one other HS device is plugged into a trainee jack at the position, the ETVS shall permit the footswitch to be used as an alternate PTT device for the trainee operator only, i.e., in parallel with the trainee jack HS PTT device only (with instructor jack operator retaining preemption capability in accordance with 10.3.3.4 above).

10.3.3.10. Split positions.

Note: Split positions permit the communications workload to be divided among two operators during busy periods. The split positions are meant to conserve console space.

- a) As designated at time of order, the ETVS shall provide split positions that can be divided for use by two operators.

- b) The ETVS shall provide a DA selector at each split position, which, when activated, shall split the position if at least one HS device is plugged into each A/G and G/G jack module.
- c) When split, the position:
 - 1) Shall be divided into a G/G portion and an A/G portion;
 - 2) Shall provide a separate jack module and a separate speaker to operate G/G communications; and a separate G/G legal recorder interface in accordance with 10.3.3.14 ;
 - 3) Shall provide a separate dual jack module and a separate speaker module to operate A/G communications; and a separate A/G legal recorder interface in accordance with 10.3.3.14;
 - 4) Shall provide, when classmarked, the G/G HS jack with audio from the A/G jack set and all audio to the A/G position HS jacks and LS;
 - 5) Shall suspend the audio connection established in 4) above whenever the G/G position is engaged in a G/G call, except incoming OVR calls;
 - 6) Shall provide a DA selector for G/G relief briefing and one DA selector for A/G relief briefing;
 - 7) At each position designated by classmark, the ETVS shall provide a DA selector which, when activated, provides the audio connection in 4) above; and,
 - 8) Shall operate in all other aspects as two independent positions.
- d) When combined, the position:
 - 1) Shall permit a single operator to operate all position functions;
 - 2) Shall direct all position LS audio to the A/G loudspeaker and the G/G loudspeaker shall be inoperable;
 - 3) The G/G jack module shall become inoperable regardless if any HS device is plugged into the G/G jack module;
 - 4) Shall enable the A/G relief briefing selector to control position relief briefing, and shall inhibit operation of the G/G relief briefing selector; and,
 - 5) Shall operate in all other respects as a single position.
- e) The split DA selector at each split position shall provide a continuous visual indication of its state.

10.3.3.11. Relief briefing.

Note: This function supports official handoff of responsibility from a departing controller to a relief controller by setting up voice communications between the two and recording these communications.

- a) The ETVS shall permit a latching selector for relief briefing to be assigned at each position by classmark during mission reconfiguration.
- b) Upon selection of the relief briefing selector, the ETVS:
 - 1) Shall establish a two-way audio connection between the trainee jack and the instructor jack such that operators plugged into these jacks may converse with each other without activation of PTT;
 - 2) Shall route audio to the legal voice recorder in accordance with 10.3.3.14; and,
 - 3) Shall provide an active indication at the relief briefing selector of the affected position.
- c) Upon subsequent deselection of the relief briefing selector, the ETVS shall discontinue the audio connections described in (b) and extinguish the visual indication of relief briefing in progress.
- d) The ETVS shall not restrict access to or operation of A/G or G/G communications functions during position relief briefing.
- e) The ETVS shall suspend the audio connection in (b) whenever a G/G or A/G call is in progress.

10.3.3.12. Facility entry door release.

- a) At each position and for each facility entry door release interface, as designated by classmark, the ETVS shall provide a non-latching selector for operation of the door release.
- b) Upon activation of a door release selector, the ETVS shall provide contact closure (in accordance with Appendix F) to the corresponding facility entry door release interface to operate a government-furnished door release solenoid.
- c) The ETVS shall provide a visual indication of whether the door is open or closed.

10.3.3.13. Position confidence test.

- a) The ETVS shall provide each operational position with a position confidence testing feature that can be invoked on demand by the operator by activation of an IA sequence.
- b) The confidence testing feature shall verify proper operation of all controls and displays.
- c) The confidence testing feature shall verify proper audio transmission.
- d) The confidence testing feature shall not cause disruption of communications functions for more than fifteen seconds at a time, and only at the position under test.
- e) The confidence testing feature shall not change the position's configuration, nor any settings or selections made by the operator.

10.3.3.14. Legal voice recording of position activity.

Note: "Legal voice recording" refers to the statutory requirement for recording of all ATC voice communications on a government-furnished logging recorder for legal and administrative purposes.

- a) The ETVS shall provide connectivity to a government-furnished voice logging recorder to record all A/G and G/G calls and relief briefings at each operational position.
- b) For each position, the ETVS shall provide a single interface to the legal recorder at the IDF

containing the audio in accordance with table 10-2.

- c) For each split position, the ETVS shall provide the following legal recorder interfaces:
 - 1) A/G portion - The ETVS shall provide a single interface to the legal recorder at the IDF containing the audio in accordance with table 10-2 where trainee and instructor refer to the A/G jack module and LS refers to the A/G loudspeaker; and,
 - 2) G/G portion - The ETVS shall provide a single interface to the legal recorder at the IDF containing the audio in accordance with table 10-2 where trainee and instructor refer to the G/G jack module and LS refers to the G/G loudspeaker.

10.3.3.15. HS/LS routing of communications

Note: Air traffic controllers typically route less immediate communications to LS, reserving HS for more important tasks. The following features will allow the controllers to tailor the HS/LS routing to their needs and to override these settings when appropriate.

10.3.3.15.1. Per-frequency A/G HS/LS selectors.

- a) For each frequency at each position, the ETVS shall provide a selector to direct incoming A/G calls either to the HS or to the LS.
- b) Each per-frequency HS/LS selector shall provide a continuous display of the actual routing in effect, which may vary due to precedence of other selectors described below.

10.3.3.15.2. G/G HS/LS selector.

- a) At each position, the ETVS shall provide a selector to direct incoming G/G call audio (other than from incoming OVR calls) either to the HS or to the LS.
- b) The G/G HS/LS selector shall provide a continuous display of the actual routing in effect, which may vary due to precedence of other selectors described below.

1. Define the following terms:

- $E_T(t)$ = audio signal to trainee HS earpiece jack after-volume control and amplitude limitation.
 $M_T(t)$ = audio signal from trainee HS MIC jack
 $E_i(t)$ = audio signal to instructor HS earpiece jack after-volume control and amplitude limitation.
 $M_i(t)$ = audio signal from instructor HS MIC jack.
 $L(t)$ = audio signal furnished to position LS after-volume control.
 $P_T(t)$ = 1 at time t if trainee PTT is engaged or G/G call is in progress requiring no PTT;
= 0 otherwise.
 $P_i(t)$ = 1 at time t if instructor PTT is engaged or G/G call is in progress requiring no PTT;
= 0 otherwise.
 $R(t)$ = Output signal to legal recorder for HS recording channel.

2. Then while calls are in progress (i.e., $P_T(t) = 1$, or $P_i(t) = 1$, or both), furnish to the legal recorder:

- $R(t)$ = $L(t) + [P_i(t) \times M_i(t)] + E_i(t)$...if both jacks occupied;
= $L(t) + [P_i(t) \times M_i(t)] + E_i(t)$...if only instructor jack occupied;
= $L(t) + [P_T(t) \times M_T(t)] + E_T(t)$...if only trainee jack occupied.

3. In addition, if relief briefing is engaged, furnish to the legal recorder

- $R(t)$ = $L(t) + [M_T(t) + M_i(t)]$...if $P_T(t) = P_i(t) = 0$.

Table 10-2. Routing and signal level for legal recorder outputs

10.3.3.15.3. Incoming OVR HS/LS selector.

- a) At each position, the ETVS shall provide a selector to direct incoming audio from incoming OVR calls either to the HS or to the LS.
- b) The incoming OVR HS/LS selector shall provide a continuous display of the actual routing in effect, which may vary due to precedence of other selectors described below).

positions (except those at which the operator has overridden it using the automatic routing override feature).

- b) Whenever any G/G call, except incoming OVR call, is in progress at a position while automatic transfer has been enabled, the ETVS shall automatically route all incoming A/G audio from all selected receivers to the LS regardless of the state of the per-frequency HS/LS selector for the selected frequencies.

10.3.3.15.4. Automatic transfer of A/G audio to LS during G/G calls.

- a) The ETVS shall be configurable via classmark to provide or not provide automatic transfer of A/G calls to LS during G/G calls, except incoming OVR calls; this setting shall be effective for all

10.3.3.15.5. Override of automatic transfer feature.

- a) The ETVS shall, at positions designated by classmark, provide a DA selector to override the facility setting for automatic transfer (i.e., to

defeat it when it is on, or to enable it when it is off).

- b) The automatic transfer override selector shall provide a continuous display of its state (which may not reflect the actual routing in effect, due to the precedence of other selectors described below).

10.3.3.15.6. Group A/G LS transfer.

- a) The ETVS shall, at positions designated by classmark, provide a selector to direct all incoming audio from all A/G frequencies at the position to the LS regardless of the state of the per-frequency HS/LS selector for each frequency.
- b) The group A/G LS transfer selector shall provide a continuous display of its state (which may not represent the actual routing in effect, due to precedence of other selectors described below).

10.3.3.15.7. Master LS transfer for all audio.

- a) The ETVS shall, at positions designated by classmark, provide a selector to direct all incoming audio from all A/G frequencies and all G/G calls (including OVR calls) at the position to the LS regardless of the state of the subordinate HS/LS routing selectors.
- b) The master LS transfer selector shall provide a continuous display of its state (which may not represent the actual routing in effect, due to precedence of other selectors described below).

10.3.3.15.8. LS routing for unattended positions

- a) Immediately upon the removal of all instruments from the HS jacks of any position, that position will be considered unattended and the ETVS shall transfer all incoming audio from A/G and G/G calls (including incoming OVR calls) to the LS.
- b) If HS is reinserted into any jack within the first thirty seconds after a position has become unattended, the ETVS shall restore incoming audio, including calls in progress, to the HS/LS routing previously selected by the operator before the position became unattended.

- c) After any position has remained unattended for more than thirty seconds consecutively, the ETVS:

- 1) Shall release any incoming G/G calls in progress at the position (including IC OVR calls);
- 2) Shall inhibit the ability to place or answer calls, select or deselect receivers and transmitters, or to perform any control action other than volume controls (e.g., for chime, HS, LS, and sidetone) and display brightness;
- 3) Shall route any subsequent incoming A/G calls on selected frequencies to the position LS;
- 4) Shall route any subsequent incoming OVR calls to the position LS; and,
- 5) Shall continue to provide call alert signals (chimes, voice alerts, and visual indications) for all incoming G/G calls.

Note: The thirty-second pause is to permit operators to change jacks or headsets without having to reactivate control functions.

- d) Upon reinsertion of the first HS instrument plug into the jacks of a position that has been unattended for more than thirty seconds (resulting in the conditions of (c) above), the ETVS:

- 1) Shall route subsequent incoming A/G and G/G calls, and A/G calls in progress, in accordance with the HS/LS routing selected by the operator before the position became unattended; and,
- 2) Shall restore the ability to place and answer calls and to perform all other control actions.

- e) The above requirements shall not apply to the G/G portion of a split position operating in combined mode (i.e.. G/G position shall not be affected by the removal or insertion of HS instruments at the G/G portion when it is being controlled from the A/G position).

10.3.3.15.9. Precedence of routing features.

- a) Selectors and features that control HS/LS routing of A/G communications shall follow the following order of precedence:
 - 1) Unattended position transfer to LS (highest precedence);
 - 2) Master LS transfer (if assigned);
 - 3) Group A/G LS transfer (if assigned);
 - 4) Automatic A/G transfer to LS during G/G call (if enabled); and,
 - 5) Per-frequency HS/LS routing.
- b) Selectors and features that control HS/LS routing of non-OVR G/G communications shall follow the following order of precedence:
 - 1) Unattended position transfer to LS (highest precedence);
 - 2) Master LS transfer (if assigned); and,
 - 3) G/G LS transfer.
- c) Selectors and features that control HS/LS routing of OVR G/G communications shall follow the following order of precedence:
 - 1) Unattended position transfer to LS (highest precedence);
 - 2) Master LS transfer (if assigned); and,
 - 3) OVR LS transfer (if assigned).

10.3.4. Access restriction and password management.

- a) The ETVS shall segregate any on-line (e.g., terminal-based) functions performed at the maintenance position and the supervisory positions from each other and from those performed at the operational positions, and shall require password entry to gain access to supervisory and maintenance functions.
- b) The ETVS shall provide facilities to permit authorized users ("superusers"), and only such users, to view, originate, assign, modify permissions of, and delete passwords.

- c) Each ETVS password shall be associated with the name of the password owner, as well as the permissions currently granted to that owner.

Note: The permissions associated with a password define what a user is able to do when he or she logs on using the password. For example, only ATC supervisors would be permitted to define and execute mission reconfiguration over resources currently in the physical configuration file.

10.3.5. Maintenance and testing functions.

10.3.5.1. Fault detection.

- a) The ETVS shall automatically detect system faults.
- b) When commercial off the shelf (COTS) items are used as LRUs in the ETVS, those items are exempt from automatic fault detection.
- c) The fault detection shall operate continually and shall not interfere with ATC communications.
- d) The ETVS shall report all fault detection to the maintenance position, to the supervisory positions, to any remote maintenance terminals, to the maintenance logging function, and to remote alarms.

10.3.5.2. Fault localizing.

- a) The ETVS shall automatically localize faults to the level of lowest replaceable unit (LRU) when the LRU has inherent fault detection.
- b) The ETVS shall report all fault localizing results to the maintenance position, to the supervisory positions, to any remote maintenance terminals, and to the maintenance logging function.

10.3.5.3. Remote maintenance terminals.

- a) The ETVS shall provide remote maintenance terminals capable of being installed and operated at distances of up to 15,000 feet from the ETVS backroom equipment.
- b) The remote maintenance terminals:
 - 1) Shall permit the user to monitor fault detection and localizing routines;
 - 2) Shall permit the user to initiate mission reconfiguration actions involving resources

under control of the maintenance position (e.g., resources excluded from physical configuration file); and,

- 3) Shall permit the user to gain access to the maintenance logging feature to view and update maintenance log data.

10.3.5.4. Fault detection and localizing equipment.

- a) The maintenance position shall provide any terminals, displays, etc. required for fault detection and fault localizing.
- b) Such terminals and displays may be mounted in equipment racks, or integrated with other ETVS terminal equipment near the central equipment racks.

10.3.5.5. System audio alignment and test point access.

- a) The maintenance position shall provide access for connecting test equipment to external A/G and G/G circuits for local testing.
- b) The maintenance position shall provide access for connecting test equipment to the inputs and outputs of position equipment.
- c) The maintenance position shall provide means to monitor the output of position equipment.
- d) The maintenance position shall provide means to monitor the input from external lines.
- e) The maintenance position shall provide means to align the ETVS for use with external lines.
- f) All test points and alignment controls shall be readily accessible without disassembly of equipment.

10.3.5.6. Maintenance logging function.

- a) The ETVS shall provide a maintenance logging function to allow users of the maintenance position and the remote maintenance terminals to access information on the recent maintenance history of the ETVS.
- b) The ETVS shall permit users to annotate the maintenance logging function by adding their

own information or updating the information already present.

- c) The ETVS shall provide a hard copy of the maintenance log upon request through the maintenance position.

10.3.5.7. Remote alarms.

- a) The ETVS shall provide additional audible and visible alarms to signal
 - 1) The detection of system faults; and,
 - 2) System overheat conditions that would lead to equipment damage or fire.
- b) The alarms shall be installed within 500 cable feet of the central equipment in locations to be provided at time of order.

10.3.6. Supervisory functions.

10.3.6.1. Supervisory recording.

Note: "Supervisory recording" refers to ad-hoc recording of position activity (with pauses removed) allowing supervisors to assess the performance of controllers by listening to their transmissions over a period of time. Supervisory recording is distinct from legal voice recording.

- a) The ETVS shall provide each supervisory position with means to record on demand all incoming and outgoing calls to any position (Ôrecorded position') selectively.
- b) The ETVS shall allow up to two supervisory recordings (i.e., of two different positions) to be in progress simultaneously at each supervisory position, and shall allow up to five supervisory recordings to be in progress simultaneously system-wide.
- c) The ETVS shall support the use of standard consumer grade cassette recorders for supervisory recording by:
 - 1) Providing an audio output to suit the MIC jack of such a recorder; and,
 - 2) Providing a voice operated contact closure to suit the REMOTE jack of such a recorder, with the contact to be closed in the

presence of audio from the position and open otherwise.

- d) As ordered by the government, the ETVS shall be provided with cassette recorders suitable for supervisory recording, complete with connector cables at least 6 feet in length.
- e) The ETVS shall provide no indication to the recorded position that the recording is in progress.

10.3.6.2. Supervisory system status display.

- a) The ETVS shall display all uncorrected maintenance actions and alarms (if any) at the supervisory position, identifying the functions (circuits, positions, etc.) affected.
- b) The ETVS shall display the status of any ongoing mission reconfigurations at the supervisory positions.
- c) The ETVS shall display system overheat conditions at the supervisory positions.
- d) If reserve power is provided, the ETVS shall display the status of the reserve power system at the supervisory position (see Appendix E for description of reserve power status).

10.3.6.3. Unmonitored receiver report.

Note: Receivers not monitored may lead to lapses in ATC coverage and so must be identified to supervisors.

- a) The ETVS shall provide the supervisory position with a visual indication of all A/G frequencies that are not being monitored (i.e., no operator has selected their corresponding receivers).
- b) The ETVS shall provide a defeatable audible alarm each time any frequency designated by classmark becomes unmonitored.

10.3.7. Mission reconfiguration.

Note: The mission reconfiguration function of the ETVS is intended to provide air traffic supervisors with the capability to redeploy ETVS position assignments and capabilities to meet changing requirements. It is also intended to provide maintenance personnel with the means to gain access to equipment and interfaces (when these have been turned over for maintenance use by air traffic control supervisors) for testing and maintenance purposes.

10.3.7.1. Mission reconfiguration items.

10.3.7.1.1. A/G communications.

10.3.7.1.1.1. Frequency assignment.

- a) During mission reconfiguration, the ETVS shall permit authorized personnel to assign A/G frequencies to positions.
- b) It shall be possible to assign each frequency to any or all positions.
- c) During mission reconfiguration, the ETVS shall permit authorized personnel to assign the initial (startup) state of all transmitter and receiver selectors at each position.
- d) During mission reconfiguration, and for each frequency, the ETVS shall permit authorized personnel to assign which transmitter and receiver (main or standby) are brought on line at startup (i.e., power-up).
- e) During mission reconfiguration, the ETVS shall permit authorized personnel to assign the initial (startup) state of the per-frequency HS/LS routing selectors at each position.
- f) During mission reconfiguration, and for each remote frequency interlock trunk for which the ETVS is assigned as the interlocked system, the ETVS shall permit authorized personnel to assign access to the remote frequency interlock trunk to vacant A/G selectors at each position.
- g) During mission reconfiguration, and for each remote preemption trunk for which the ETVS is assigned as the preempting system, the ETVS shall permit authorized personnel to assign access to the remote preemption trunk to vacant A/G selectors at each position.

10.3.7.1.1.2. Emergency frequency operation.

During mission reconfiguration, the ETVS shall permit authorized personnel to designate which A/G frequencies are to be operated using emergency frequency procedures.

10.3.7.1.1.3. Automatic transfer.

- a) During mission reconfiguration, the ETVS shall permit authorized personnel to designate whether

all positions will have or not have automatic transfer.

- b) During mission reconfiguration, the ETVS shall permit authorized personnel to assign DA selectors to any or all positions to override the facility automatic transfer setting for that position only.

10.3.7.1.1.4. Local preemption.

During mission reconfiguration, and for each A/G frequency, the ETVS shall permit authorized personnel to designate which positions have preemption privileges over the frequency.

10.3.7.1.1.5. Group A/G LS transfer.

- a) During mission reconfiguration, the ETVS shall permit authorized personnel to assign DA selectors to any or all positions for operation of group A/G LS transfer.
- b) During mission reconfiguration, the ETVS shall permit authorized personnel to assign the initial (startup) state of any group A/G LS transfer selectors assigned.

10.3.7.1.1.6. Frequency addition.

During mission reconfiguration, the ETVS shall permit authorized personnel to designate by classmark which positions have frequency addition privileges.

10.3.7.1.2. G/G communications.

10.3.7.1.2.1. G/G circuits (non-IC).

- a) During mission reconfiguration, the ETVS shall permit authorized personnel to assign DA selectors to any or all positions for the operation of G/G trunks, trunk groups, or circuits installed on the ETVS.
- b) It shall be possible to assign each position to have access to any or all circuits.

10.3.7.1.2.2. IC assignments.

During mission reconfiguration, the ETVS shall permit authorized personnel to assign DA selectors to any or all positions for the placement of IC calls (to be connected on either an OVR or a non-OVR basis) to any other positions.

10.3.7.1.2.3. Circuit privacy.

During mission reconfiguration, the ETVS shall permit authorized personnel to designate whether each external G/G circuit is to have privacy operation.

10.3.7.1.2.4. Restriction of access to circuits.

During mission reconfiguration, the ETVS shall permit authorized personnel to designate which positions are authorized to access each G/G circuit (via DA and IA).

10.3.7.1.2.5. OVR call operation for external G/G circuits.

During mission reconfiguration, the ETVS shall permit authorized personnel to configure any external G/G circuit or trunk group to permit incoming calls to be connected on an OVR basis, except when the external G/G circuit does not offer positive called party disconnect signaling.

10.3.7.1.3. G/G call functions.

10.3.7.1.3.1. Call hold.

During mission reconfiguration, the ETVS shall permit authorized personnel to assign DA selectors to any or all positions for operation of the call hold function.

10.3.7.1.3.2. Progressive conference calling.

During mission reconfiguration, the ETVS shall permit authorized personnel to assign DA selectors to any or all positions for placement of progressive conference calls.

10.3.7.1.3.3. Preset conference calling.

During mission reconfiguration, the ETVS shall permit authorized personnel to define lists of callers for preset conferences, and to assign DAs for preset conference call placement to any or all positions.

10.3.7.1.3.4. Call forwarding.

During mission reconfiguration, the ETVS shall permit authorized personnel to assign DA selectors to any or all positions for operation of the call forwarding function.

10.3.7.1.3.5. Hook flash and ringdown.

During mission reconfiguration, the ETVS shall permit authorized personnel to assign a DA selector to any or all positions for operation of the hook flash function and the ringdown function.

10.3.7.1.3.6. Override of automatic transfer.

During mission reconfiguration, the ETVS shall permit authorized personnel to assign DA selectors to any or all positions for override of HS/LS automatic transfer.

10.3.7.1.3.7. G/G HS/LS transfer.

- a) During mission reconfiguration, the ETVS shall permit authorized personnel to assign DA selectors to any or all positions for HS/LS transfer of G/G calls.
- b) During mission reconfiguration, the ETVS shall permit authorized personnel to assign the initial (startup) state of any G/G HS/LS transfer selectors assigned.

10.3.7.1.3.8. OVR HS/LS transfer.

- a) During mission reconfiguration, the ETVS shall permit authorized personnel to assign DA selectors to any or all positions for HS/LS transfer of incoming audio from incoming OVR calls.
- b) During mission reconfiguration, the ETVS shall permit authorized personnel to assign the initial (startup) state of any OVR HS/LS transfer selectors assigned.

10.3.7.1.4. Speed dial assignment.

During mission reconfiguration, the ETVS shall permit authorized personnel to define speed dial sequences and assign codes or selectors for their activation.

10.3.7.1.5. Position monitoring.

During mission reconfiguration, the ETVS shall permit authorized personnel to assign DA selectors to any or all positions for operation of the position monitoring function.

10.3.7.1.6. A/G-G/G coupling.

During mission reconfiguration, the ETVS shall permit authorized personnel to assign DA selectors to any or all positions for A/G-G/G coupling.

10.3.7.1.7. Public address.

During mission reconfiguration, the ETVS shall permit authorized personnel to assign DA selectors to any or all positions for access to the public address system.

10.3.7.1.8. Position control.

10.3.7.1.8.1. Relief briefing.

During mission reconfiguration, the ETVS shall permit authorized personnel to assign DA selectors to any or all positions for relief briefing operation.

10.3.7.1.8.2. Door release.

During mission reconfiguration, the ETVS shall permit authorized personnel to assign DA selectors to any or all positions for the operation of any or all facility entry door release circuits installed on the ETVS.

10.3.7.1.8.3. Master LS transfer for all audio.

During mission reconfiguration, the ETVS shall permit authorized personnel to assign DA selectors to any or all positions for the operation of master LS transfer for all audio.

10.3.7.1.9. DA selector latching.

During mission reconfiguration, the ETVS shall permit authorized personnel to assign latching or nonlatching capabilities for DAs having this choice.

10.3.7.1.10. Position numbering.

- a) During mission reconfiguration, the ETVS shall permit authorized personnel to assign position numbers for the purpose of placing and receiving IC and selective IP calls.
- b) During mission reconfiguration, the ETVS shall permit authorized personnel to assign group addresses for the purpose of receiving selective IP calls; incoming calls bearing such addresses shall be directed to each position in the group.

10.3.7.2. Mission reconfiguration map creation and editing.

- a) The ETVS shall provide facilities via the supervisory and maintenance positions, protected by password, to create, modify, and store mission reconfiguration maps (which shall consist of structured listings of reconfiguration items described above).

- b) The ETVS shall provide on-line storage of mission reconfiguration maps.
- c) The ETVS shall permit mission reconfiguration maps to be copied to removable media for backup and storage.
- d) The ETVS shall provide graphic or mnemonic aid on-line during map creation and editing such that the operator need not rely upon printed documentation to complete a valid map.
- e) The ETVS shall provide on-screen and printed reports on the content of reconfiguration maps.
- f) The ETVS shall permit maps to be defined for mission reconfiguration involving as few as one and as many as all positions.
- g) The ETVS shall provide reports on screen and in hard copy of the current configuration.
- h) The ETVS shall provide "cut and paste" procedures or similar on-line aids to reduce repetitive data entry in assembling mission reconfiguration maps.
- e) The ETVS shall require no more than five minutes to prepare reconfiguration data, measured from the time reconfiguration is invoked by the operator to the time that the ETVS requests the first position acknowledgment of reconfiguration (or to the time that the ETVS performs the reconfiguration, for resources that do not require acknowledgment).
- f) The ETVS shall interrupt service for no more than six seconds at each position being reconfigured, measured from the time the operator acknowledges reconfiguration to the time the new configuration is ready for use.

10.3.7.4. Acknowledgment of mission reconfiguration.

10.3.7.3. Invocation of mission reconfiguration.

- a) The ETVS shall permit the operator to invoke mission reconfiguration maps from the supervisory and maintenance workstations by typing a valid map name or by selection of a valid name from a menu or list displayed at the workstation.
- b) The ETVS shall examine mission reconfiguration maps before initiating them to ensure that they are valid (e.g., file may be corrupted or may call for resources that are not installed or are excluded from the physical configuration file) and shall, if errors are found, report them to the initiating operator and suspend the reconfiguration process without affecting any system resources, and prompt operator to terminate or continue process.
- c) The ETVS shall require entry of a valid password before initiating any mission reconfiguration function.
- d) The ETVS shall not interrupt service during mission reconfiguration on those positions and external interfaces not affected by the mission reconfiguration.
- a) The ETVS shall provide a visual indication of pending mission reconfiguration to operators at affected positions.
- b) The ETVS shall require each position operator affected by an ongoing mission reconfiguration to signal positive acknowledgment (e.g., by pressing a selector) before reconfiguring the position.
- c) Once the acknowledgment of reconfiguration has been received from a position, the ETVS shall disconnect calls in progress at that position, release call forwarding in effect from that position, and proceed with reconfiguration
- d) Forwarding conditions in effect at the position shall remain in effect after the configuration has been accepted.
- e) The ETVS shall not require acknowledgment to reconfigure unattended positions (see 10.3.3.15.8).
- f) Unattended positions with call forwarding in effect shall:
 - 1) Provide visual indications of pending mission reconfiguration to the unattended position.
 - 2) Require insertion of a HS instrument into the jacks of the position to complete the reconfiguration of the position.
 - 3) Require the operator to signal positive acknowledgment before reconfiguring the position.

10.3.7.5. Physical configuration file.

- a) The ETVS shall maintain a physical configuration file listing the type, identification, and address (or location) of all positions, frequencies, and circuits.
- b) The ETVS shall permit the operator at the supervisory workstation to modify a physical configuration file to classify each position, frequency, and circuit installed on the system as one of the following:
 - 1) On line—available for reconfiguration from the supervisory workstation only (i.e., reconfiguration attempts from the maintenance workstation involving on-line resources are to be considered invalid per 10.3.7.3 (b));
 - 2) Maintenance busy—available for reconfiguration from the maintenance workstation only (i.e., reconfiguration attempts from the supervisory workstation involving maintenance-busy resources are to be considered invalid as per 10.3.7.3 (b)); or,
 - 3) Off line—not available for reconfiguration (i.e., any reconfiguration attempts involving such resources are to be considered invalid as per 10.3.7.3 (b)).
- c) Conversely, the ETVS shall permit the operator at the supervisory and maintenance positions to put positions and circuits back into service by reinstating them in the physical configuration file.
- d) The ETVS shall require entry of a valid password before permitting the physical configuration file to be altered.
- e) The ETVS shall permit operators at the supervisory and maintenance positions to obtain hard copy printouts of the contents of the physical configuration file.

10.3.7.6. Default configuration.

The ETVS shall continually retain the most recent configuration indefinitely in non-volatile memory, and shall use this configuration when restarting the system (e.g., for unattended restart after extended power failure).

10.3.8. System expansion and physical reconfiguration.

10.3.8.1. General requirements.

- a) The ETVS shall be expandable up to its maximum size as specified in Appendix O.
- b) The ETVS shall be expandable in modules or increments of one position at a time and one external interface at a time.
- c) Where additional modules are required for expansion of system capabilities (e.g., additional banks of DA selectors, additional external interface modules), these shall be connectorized and installable by trained government personnel using only common tools without wire wrap or soldering.

Note: Common tools are defined as tools normally used in electronic system maintenance that may be purchased from many sources other than the system contractor (pliers, screwdrivers, etc.)

- d) To the extent that software changes are required to effect expansion or physical reconfiguration,
 - 1) They shall be limited to the editing or substitution of static data (such as maps, tables, or files, and not executable machine code); and,
 - 2) The ETVS shall permit such changes to be accomplished on site by trained government personnel by entry at a computer terminal or by loading of data from tape or disk.
- e) The ETVS shall require no more than 60 minutes of clock time (excluding carpentry, cable pulling, and administrative or logistical activities) to install any additional position, radio interface, or trunk interface.
- f) In no case shall the process for installation or reconfiguration of a position restrict operations at other positions, except for testing of resources appearing at more than one position (e.g., a trunk or radio frequency).
- g) In no case shall the process for installation or reconfiguration of an external G/G circuit or A/G frequency restrict the use of other circuits or frequencies at any position.

10.3.8.2. Facility PTT alternatives.

- a) The ETVS shall permit trained maintenance personnel to switch between two different sets of procedures for PTT operation (the selected procedures to be in effect at all positions throughout the facility):
 - 1) *Alternative 1:* PTT activation (i) connects the operator to the selected A/G transmitters while maintaining position audio to any G/G calls in process, (ii) keys those transmitters, (iii) transfers all incoming G/G audio to the position LS except for incoming override calls. PTT release (i) unkeys the selected A/G transmitters, (ii) disconnects the operator from these transmitters, and (iii) resumes all incoming G/G call audio.
 - 2) *Alternative 2:* Same as alternative 1, except that PTT activation will not connect operator to A/G transmitters or key those transmitters until the operator has terminated or placed on hold all ongoing G/G calls (except for incoming override calls, where such termination is not possible).
- b) The set of PTT procedures to be put into effect at each facility will be determined by the government and indicated before time of installation.

10.3.8.3. Operational position installation.

- a) The ETVS shall permit trained maintenance personnel to
 - 1) Install or relocate sets of operational position equipment and make them available for use in operational communications;
 - 2) Designate the identifier (up to 7 alphanumeric characters including spaces and punctuation) to identify the position on IC selectors, in maintenance and supervisory terminal reports, etc.; and,
 - 3) Assign the code to be used for access to each position via IA and on selective calls.
- b) The ETVS shall permit trained maintenance personnel to reconfigure, test, or remove operational positions that have been written out of the physical configuration file.

10.3.8.4. G/G circuit installation.

- a) The ETVS shall permit trained maintenance personnel to:
 - 1) Install new G/G circuits on the system and make them available for use in operational communications;
 - 2) Define the types of supervision, ring, and dial signaling to be used with each circuit (see Appendix F);
 - 3) Define whether or not called party disconnect signaling is provided by each circuit (for purposes of defining call release procedures);
 - 4) Designate the identifier (up to 7 alphanumeric characters including spaces and punctuation) to be displayed at DA selectors assigned to provide access to each circuit;
 - 5) Assign the code to be used for access to each circuit via IA; and,
 - 6) Adjust audio levels of analog G/G circuit interfaces to adapt them to the site (per Appendix F).
- b) The ETVS shall permit trained maintenance personnel to:
 - 1) Assign each supervised trunk into a trunk group;
 - 2) Assign a directionalization classmark (incoming, outgoing, two-way) to each trunk group;
 - 3) Assign an override/routine classmark to each trunk group; and,
 - 4) Assign the code to be used for access to each trunk group via IA.
- c) The ETVS shall permit trained maintenance personnel to reconfigure, test, or remove G/G circuits that have been written out of the physical configuration file.

10.3.8.5. A/G frequency installation.

- a) The ETVS shall permit trained maintenance personnel to:

- 1) Install new A/G frequencies on the system and make them available for use in operational communications;
 - 2) Designate the frequency display (up to 7 alphanumeric characters including decimal point) to be displayed at frequency selectors assigned to provide access to each frequency; and,
 - 3) Adjust audio levels of analog voice interfaces to adapt them to the site (per Appendix H).
- b) The ETVS shall permit trained maintenance personnel to designate the characteristics of interfaces with A/G frequencies including (see Appendix H):
- 1) Relay closure circuit type;
 - 2) Need for main/standby transmitter switching; and,
 - 3) Need for main/standby receiver switching.
- c) The ETVS shall permit trained maintenance personnel to reconfigure, test, or remove A/G frequencies that have been written out of the physical configuration file.

10.3.8.6. Remote preemption and frequency interlock trunks.

The ETVS shall permit trained maintenance personnel to:

- a) Install new remote preemption and frequency interlock trunks on the system and make them available for use in operational communications;
- b) Designate the A/G frequency to be displayed at selectors assigned to provide access to each such trunk;
- c) Designate for each remote preemption trunk whether the ETVS is to be the preempting system or the non-preempted system;
- d) Designate for each remote frequency interlock trunk whether the ETVS is to be the interlocking or interlocked system; and,
- e) Adjust audio levels of analog voice interfaces to adapt them to the site (per Appendix E).

10.3.8.7. Installation of other interfaces.

10.3.8.7.1. Door release.

The ETVS shall permit trained maintenance personnel to connect government furnished door release solenoids and door-open contacts for operation by the ETVS.

10.3.8.7.2. Public address.

The ETVS shall permit trained maintenance personnel to connect government furnished public address circuits to be operated by the ETVS.

10.3.8.7.3. Supervisory position terminals.

The ETVS shall permit trained maintenance personnel to install or relocate supervisory position terminals.

10.3.8.7.4. Maintenance terminals.

The ETVS shall permit trained maintenance personnel to install or relocate maintenance terminals including remotely-located maintenance terminals.

10.3.8.7.5. Maintenance processor subsystem (MPS) and maintenance data terminal (MDT).

The ETVS shall permit trained maintenance personnel to install and initiate the MPS interface, and to connect MDTs.

10.3.9. Radio and trunk legal recording.

10.3.9.1. Radio interface recording.

- a) The ETVS shall provide connectivity to a government furnished voice logging recorder to record all audio to and from each frequency designated at time of order and modified thereafter by qualified government personnel.
- b) For purposes of legal recording, the ETVS shall combine the audio provided to the on-line transmitter (main or standby) and the on-line receiver (main or standby) associated with the frequency onto a single connection.

10.3.9.2. Trunk/circuit interface recording.

The ETVS shall provide connectivity to a government furnished voice logging recorder to record all audio to and from each G/G trunk or circuit designated at time of order and modified thereafter by qualified government personnel.

APPENDIX B: CORE PERFORMANCE REQUIREMENTS

20. Core performance requirements.

20.1. Description and remarks.

This appendix provides basic system performance requirements that the ETVS must meet.

20.2. Requirements.

20.2.1. Call blocking probability.

- a) The ETVS shall not block any incoming or outgoing A/G call, nor delay any such call past the limits stated in 20.2.2., in traffic conditions ranging in magnitude up to the communications test load (see 4.3.7) for any reason other than the unavailability or prior occupancy of an external (non-ETVS) resource.
- b) The ETVS shall not block or delay (past the limits of 20.2.2) more than 0.1% of G/G calls incoming or outgoing, in traffic conditions up to the test load (see 4.3.7) for any reason other than the unavailability or prior occupancy of an external (non-ETVS) resource.

20.2.2. Throughput and response times.

20.2.2.1. A/G PTT engage.

The ETVS shall require no more than 50 milliseconds (ms) to engage PTT in at least 99.9% of all attempts, measured from the instant of closure of PTT device (HS or footswitch) to the presence of PTT signal at the radio interface.

20.2.2.2. IC call connection.

The ETVS shall require no more than 100 ms to connect any IC call, measured from the instant of activation of the IC OVR or IC answer selector for the call to the instant that the audio connection is established between positions.

20.2.2.3. Other G/G call connection–placement.

The ETVS shall require no more than 200 ms to connect any outgoing G/G call (including IP calls, voice calls, and external network calls), measured from the instant of activation of the appropriate selector for the call to the instant that outgoing call signaling is present on the trunk interface.

20.2.2.4. Other G/G call connection–receipt.

The ETVS shall require no more than 200 ms to connect any incoming G/G call other than IC (including IP calls, voice calls, and external network calls), measured from the instant of activation of the appropriate selector to answer the call to the instant that incoming call audio is received at the position HS jack.

20.2.2.5. Emergency frequency PTT.

The ETVS shall require no more than 100 ms to engage PTT, measured from the instant of activation of the emergency frequency TX selector to the presence of PTT signal at the radio interface.

20.2.2.6. M/S TX/RX transfer.

The ETVS shall require no more than 200 ms to generate M/S transfer signal, measured from the instant that the M/S TX/RX selector is engaged until the transfer signal is present at the A/G interface.

20.2.3. System startup delay.

The ETVS shall not require more than 5 minutes for startup, measured from the instant of application of main power to the first instant that all positions are available for all assigned functions and shall require no manual intervention.

20.2.4. Audio performance.

- a) The following noise and distortion limits shall be applied to all voice connections (i.e., calls, legal recorder connections) properly terminated at each end, unless otherwise specified.
- b) The term “1004 Hz” shall be understood to mean any sinusoidal test tone having a frequency between 1000 and 1020 Hz; 1004 Hz has been standardized in the telephone industry.
- c) The following requirements are based upon the transmission plan given in 40.2.1.1. Where level translation (i.e., loss or gain) is required to adapt the ETVS to external equipment not operating at these levels, it will be acceptable to measure compliance with these requirements while the level translation is switched out.

20.2.4.1. Noise.

The following noise and crosstalk measurements shall apply to the ETVS in traffic conditions up to the communications test load (see 4.3.7).

20.2.4.1.1. Background noise.

- a) The ETVS shall exhibit C-weighted background hum and noise, measured at any output, with the exception of the legal recorder interface, of no more than 20 dBrnC.
- b) The ETVS shall exhibit C-weighted background hum and noise, measured at the legal recorder interface, of no more than 29 dBrnC.
- c) The ETVS shall exhibit unweighted background hum and noise over the voice band (300-3000 Hz), measured at any output, of no more than 39 dBrn.

20.2.4.1.2. Impulse noise.

During any thirty-minute period, on any single connection, the ETVS shall exhibit no more than one impulse hit with a level exceeding 47 dBrnC, measured at any output.

20.2.4.1.3. Correlated impulse noise.

During any five-minute interval at any operational position monitoring up to six radio receivers, the ETVS shall exhibit no more than one impulse hit with a level exceeding 55 dBrnC, measured at any output.

Note: This requirement refers to periodic noises that might be generated by scheduled system activity such as polls.

20.2.4.1.4. Crosstalk.

The ETVS shall exhibit crosstalk coupling with other simultaneous voice connections no greater than -66 dB. Crosstalk shall not be audible to the user.

20.2.4.2. Frequency response.

20.2.4.2.1. In-band response.

For any frequency between 300 and 3000 Hz, the ETVS shall exhibit an insertion loss (measured at any output) that does not deviate by more than -0.5 dB and +1.0 dB from the insertion loss observed at 1004 Hz.

20.2.4.2.2. Out-of-band response.

The ETVS shall attenuate frequencies above 3000 Hz and below 300 Hz at the rate of at least 20 dB per decade.

20.2.4.2.3. Response at 60 Hz.

The ETVS shall exhibit an attenuation of at least 20 dB below the 1004-Hz level at a frequency of 60 Hz.

20.2.4.3. Distortion.

For input signals at a constant level, and at any single frequency in the range from 300 to 3000 Hz, the ETVS shall produce a corresponding total output power level at all other frequencies (save for an appropriate filter band about the single frequency) and at any output of at least 28 dB below the output level at the single frequency.

20.2.4.4. Longitudinal balance.

Each G/G trunk/circuit interface and A/G radio interface (audio portion only) of the ETVS shall exhibit a longitudinal balance of at least 58 dB as measured at an intermediate distribution frame with all circuits properly terminated using the test conditions of EIA/TIA-464A-1.

20.2.4.5. Gain tracking linearity.

- a) The ETVS shall regulate the linearity of each transmission path through the ETVS such that, for a 1004-Hz sine wave signal, variations in the output level of the ETVS correspond to variations in the input level within the tolerances and ranges specified below (refer to the requirements for the analog transmission plan in 40.2.1.1 for a discussion of the relative measures in dBm0 used below):
 - 1) For input signals between +3 and -37 dBm0, tolerance of ± 0.5 dB;
 - 2) For input signals between -37 and -50 dBm0, tolerance of ± 1.0 dB.
- b) For signals that cause the HS power limiter (see 10.3.3.6) to engage, the HS output (earpiece) path is exempt from the requirements above.
- c) To the extent that linearity of gain is deliberately set aside in order to meet other requirements of this specification (i.e., HS power limiter in

Appendix A, 10.3.3.6, and A/G transmit audio compression in Appendix H, 80.3.1.2), those portions of the audio path associated with these features are exempt from the requirements above.

20.2.4.6. Hybrid Balance.

At all position-to-two-wire-trunk interfaces, the ETVS shall provide a minimum echo return loss of 28 dB and a minimum single frequency return loss of 14 dB.

20.2.4.7. Multiple-access level regulation.

The ETVS shall regulate voice levels or use audio distribution methods such that no more than 3 dB loss results from multiple listeners to any position or external trunk (as during conferences).

20.2.4.8. Return loss.

For each 4-wire trunk/circuit, public address, and legal recorder interface, the ETVS shall exhibit a minimum return loss of 20 dB over the frequency range of 200 to 500 Hz, and a minimum return loss of 26 dB over the frequency range of 500 to 3,400 Hz.

20.2.4.9. VOX operation.

- a) Any interfaces using voice activated circuitry (VOX) to control voice connectivity based upon the magnitude of audio-frequency energy in the signal (e.g., voice call or incoming radio call) shall ensure immediate activation of the circuit upon receipt of incoming voice, without noticeable distortion or suppression of incoming speech.
- b) The threshold of any VOX circuits used to control voice connectivity shall be sufficiently high to ensure that idle, spurious, or impulse noise will not activate the circuits.
- c) VOX circuits used to control A/G squelch break indicators shall be adjusted so as to operate the indicator in the presence of audio, but not during periods of idle telephone circuit noise.

Note: these requirements also apply to algorithms used in digital systems to detect audio frequency energy through numerical means.

20.2.4.10. Intelligibility.

The ETVS shall pass an intelligibility test.

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APPENDIX C: REQUIREMENTS FOR CONTROLS, DISPLAYS, AUDIO WARNINGS, AND LABELS

30. Requirements for controls, displays, audio warnings, and labels.

30.1. Description and remarks.

This appendix provides basic requirements for controls (including selectors, knobs, switches, touch entry zones, etc.) and displays (including those associated with controls, such as programmable frequency displays, visual indications of call status provided at call selectors, as well as fixed displays and labels).

Note: There are many acceptable approaches that can be taken toward providing ETVS controls and displays; these requirements have been written so as not to favor any particular approach, and certain of the requirements may not fully apply in some approaches.

30.2. Requirements.

30.2.1. Controls.

30.2.1.1. Operation of selectors.

- a) Selectors used for G/G communications access, special function activation, and frequency control shall be mechanical pushbuttons or electronic emulations thereof.
- b) Latching selectors shall remain in the same logical state between successive touch actions (e.g., on-off switch).
 - 1) DA selectors identified as “locking/latching” shall activate when pressed.
 - 2) In the event of “dragging” to another selection area on the screen, the selector pressed originally shall remain activated.
- c) Non-latching selectors shall change their logical state only during sustained touch action (e.g., momentary switch).
 - 1) DA selectors identified as “Non-locking/Non-latching” shall activate when pressed.

- 2) In the event of “dragging” to another selection area on the screen, the original area shall remain selected.

- d) The ETVS shall not suffer any detrimental effects, nor cause any such effects on operational communications, should operators attempt to activate unassigned selectors or activate more than one selector simultaneously.

30.2.1.2. Consistency of movement of controls.

- a) The direction of movement for each ETVS control shall be consistent with the related movement of any associated display.
- b) Movement of ETVS controls in the directions forward, up, to the right, or in clockwise rotation shall increase the quantity regulated by the controls.
- c) Activation of non-latching controls shall turn on their related functions (e.g., emergency frequency transmit, hook flash).

30.2.1.3. Arrangement and grouping of controls.

- a) Controls that must be operated in sequential fashion to perform a function shall be grouped together along with any associated displays.
- b) Whenever several related or sequential operations are combined into a single control, the operations shall be grouped in order of their occurrence (e.g., washing machine control knob). The need to activate a subsequent step by cycling through a control’s “off” state shall be avoided.
- c) The most important and most frequently used controls shall be placed in the most favorable positions for visibility and ease of use.
- d) Controls that are similar or identical in function shall operate in the same manner throughout the ETVS.
- e) Controls used primarily for maintenance and occasional adjustment shall be protected during

normal ETVS operation, and shall be readily accessible during maintenance actions.

- f) Knobs and jacks shall be easily accessible to the operator.
- g) Knobs used in jackboxes (e.g., volume controls) shall not protrude outside the jackbox recess.

30.2.1.4. Prevention of accidental activation of controls.

To minimize risk of accidental activation of controls that would have detrimental effects on ongoing ETVS operations (e.g., call release key, reconfiguration functions), the ETVS shall, as necessary and appropriate:

- a) Locate controls such that the operator is not likely to strike or move them in the normal sequence of control movements;
- b) Use removable or openable covers (in such cases, the ETVS shall avoid the use of safety wire in sealing the covers);
- c) Use an interlock mechanism (e.g., detents, lock levers, pull-to-adjust) requiring an additional mechanical action along with the control adjustment.

30.2.2. Displays.

30.2.2.1. Location and arrangement of displays.

- a) ETVS displays shall be legible without use of special equipment by operators with normal vision in seated and standing positions, at angles of view ranging up to 45 degrees off-axis, at distance of up to six feet, and in conditions ranging from total darkness up to maximum ambient lighting conditions called for in this specification.
- b) ETVS displays shall be constructed, arranged, and mounted to minimize the effects of reflection or glare. Shields or filters may be used for this purpose, provided they do not interfere with display visibility.

30.2.2.2. Information content of displays.

- a) The ETVS shall limit the display of information to that which is pertinent to the operator's job

(i.e., information called for in the functional requirements of this specification).

- b) The ETVS shall display information in the form most immediately useful to operators (i.e., without requiring transposition, computation, interpolation, or conversion of data, or the lookup of additional data).
- c) The ETVS shall avoid redundancy in the display of information to individual operators.
- d) All selector displays (DAs, frequency selectors) shall be consistent in appearance with regard to identifying whether their associated functions are active or not.

30.2.2.3. Display symbols.

- a) Symbols used on ETVS displays (e.g., numerals and letters) shall be at least 0.18 inches in height, including descenders.
- b) Symbols formed by dot matrices on ETVS displays (e.g., raster or dot-matrix display devices) shall be formed by a matrix of dots at least five wide and seven high.

30.2.2.4. Legibility of selector displays.

Information displays associated with selectors (e.g., labels on DA selectors) shall be legible regardless of the state of the associated selectors.

30.2.2.5. Sunlight readability of tower cab displays.

30.2.2.5.1 Legend switches and indicators.

These requirements refer to transilluminated display elements (e.g., LED and incandescent indicators) intended for use in the tower cab.

- a) Transilluminated portions of transilluminated display elements shall, when the display is energized to maximum brightness, provide a minimum contrast of 0.6 with respect to background illumination, when measured according to the test procedures of 4.3.8.
- b) Non-illuminated (blocked or opaque) portions of transilluminated display elements shall, when the display is energized to maximum brightness, provide a minimum contrast of 0.1 with respect to

background illumination, when measured according to the test procedures of 4.3.8.

30.2.2.5.2 Electronic and electro-optic displays.

Electronic and electro-optical displays (e.g., LCD, CRT and electroluminescent displays) for use in the tower environment shall provide the minimum contrast specified in Table II of MIL-L-85762A when measured in accordance with test procedures of 4.3.8.2 in a combined environment consisting of 7000 foot-candle diffuse illumination and the specular reflection of a 7000 foot-lambert glare source.

30.2.2.6. Brightness range of displays.

30.2.2.6.1 Legend switches and indicators.

- a) Tower cab displays shall be clearly legible in conditions ranging from night darkness up to the maximum conditions implied in the test procedures of 4.3.8.
- b) TRACON displays shall be clearly legible in conditions ranging from room darkness up to an ambient light level of 50 foot-candles.

30.2.2.6.2 Electronic and electro-optic displays.

- a) Tower cab displays shall be clearly legible in conditions ranging from night darkness up to sunlight readability levels specified in 30.2.2.5.2.
- b) For electronic and electro-optic displays used in the TRACON environment when measured in accordance with test procedures of 4.3.8.2 in a combined environment consisting of 50 footcandle diffuse illumination and the specular reflection of a 10 foot-lambert glare source, the ETVS:
 - 1) Shall exhibit on-to-background contrast (CL) of a lighted (or active) display image element greater than or equal to 0.6;
 - 2) Shall exhibit on-to-off contrast (C_I) of a display image element greater than or equal to 0.6;
 - 3) Shall exhibit off-to-background contrast (C_{UI}) of an unlighted (or deactivated) display image element less than or equal to 0.25.

30.2.2.7. Brightness balance of displays.

Under normal operation, individual self-illuminated ETVS display components shall be of the same general level of brightness, except as adjusted by the operator.

30.2.2.8. Contrast of displays.

Where differences in color or level of illumination are used to communicate information in ETVS displays (e.g., status of DA selectors), these differences shall be clearly visible in all lighting conditions and from all viewing positions.

30.2.2.9. Dimmer controls for illuminated displays.

Self-illuminated ETVS display components shall be provided with dimmer controls.

30.2.2.10. False indications from displays.

Self-illuminated ETVS displays shall not appear to be illuminated when they are intended to be extinguished, or extinguished when illuminated.

30.2.3. Keyboards and pointing devices.

- a) Alphanumeric keyboards supplied with the supervisory and maintenance positions shall conform to the standard "QWERTY" layout and shall include numeric and cursor-control keypads.
- b) Keyboard keys shall have a nominal diameter (height or width) of 0.5 inches, excluding special keys for "enter", "shift", and similar functions.
- c) Keyboards shall have displays to indicate whenever locking keys (e.g., shift lock) are locked.
- d) Detached pointing devices (mice, trackball units, etc.) provided as part of the ETVS shall be connected to their associated equipment (i.e., central processing units) by a single cord (or shall be cordless) and shall be removable.

30.2.4. Touch entry devices (TEDs).

Note: The following requirements apply to all touch-entry devices that use membranes, resistance grids, or optical interruption techniques to provide integrated displays and controls divided into programmable "zones".

30.2.4.1. Physical characteristics of TEDs.

- a) TED surfaces shall minimize glare.
- b) TED surfaces shall be impervious and scratch resistant to fingernails, pens, pencils, and other objects that might typically be used for touch operation.
- c) TEDs shall permit periodic cleaning or wiping without operation of the controls and shall not be damaged in any way by normal commercial cleaning agents (e.g., ammoniated window cleaner or detergent-based cleaners) or by mildly corrosive moisture such as human perspiration.
- d) TEDs shall not exhibit optical noise (flicker, “snow”, etc.) induced by external sources (e.g., fluorescent tubes, radio frequency equipment, power supply transformers, etc.).
- e) TEDs shall not operate falsely due to vibration or loud noises or liquid spills.
- f) TEDs shall not operate falsely due to sudden changes in humidity, temperature, or air currents.

30.2.4.2. Activation of TEDs.

- a) TEDs shall respond to touch action by fingers or inert pointers (e.g., pencils) having a diameter of from 0.25 to 1.0 inches, and shall resolve the coordinates of the touch to the zone (i.e., “button”) containing the greatest percentage of the touched area.
- b) TEDs shall preclude potential misoperation of controls due to excessive parallax between the touch detection plane and the display plane at distances of up to 3 feet and sight angles of up to 60 degrees off-axis.
- c) TEDs shall detect and discriminate touches at the rate of up to ten per second in the same or different zones.
- d) TEDs shall detect and resolve simultaneous touches in two or more different zones.
- e) TEDs shall detect and resolve motion of the touch area (“dragging”) across the touch surface.
- f) Any TED zone programmed to emulate a latching selector shall not be latched unless and

until the touch is released within the zone (i.e., and not dragged to another zone).

- g) TED zones shall provide positive visual indication of response to touch, using reverse video, color changes, intensity changes, or similar techniques.
- h) When the TED displays multiple screens or pages of controls and displays, the ETVS shall manage these screens or pages such that the most important features (e.g., incoming call indications) and most frequently used features are available immediately whenever required by the operator.

30.2.5. Audio warnings.

30.2.5.1. Characteristics of audio alarms.

- a) ETVS audio warning devices shall emit a fundamental audio frequency between 500 and 3,000 Hz.
- b) Audio warning signals shall not exceed an unweighted root-mean-square sound pressure level of 88 dBSPL, measured at an on-axis distance of one meter from the sound source.
- c) All ETVS audio warning devices shall be equipped with test devices, access for test equipment, or other means to verify their operation.

30.2.5.2. Controls for audio alarms.

- a) The ETVS shall permit the operator to silence audio warning devices.
- b) The ETVS shall permit the operator to silence the current audio alarm without affecting future alarms.

30.2.6. Control-display integration.

- a) Controls shall be placed so as not to obscure their associated displays during operation.
- b) The relationship of each control with its associated displays (if any) shall be apparent from one or more of the following:
 - 1) The placement of the control and display closer to each other than to other displays and controls;

- 2) Use of labeling or panel marking (e.g., connecting lines);
- 3) Color or shape coding.
- c) The ETVS shall provide appropriate visual, audible, or tactile feedback to indicate control activation. This feedback shall be in synchrony with system response.

30.2.7. Labels.

This section applies to the labeling of items such as switches, indicators, and panels.

30.2.7.1. Location of labels.

- a) ETVS labels shall be oriented horizontally and shall be readable from left to right.
- b) ETVS labels may be oriented vertically only when they are not critical to personnel safety or performance, and when space is limited. Vertically oriented labels shall be readable from top to bottom.
- c) Labels shall be located in correct relationship to the items (e.g., controls, dials) they are meant to identify.
- d) Permanent labels shall be secured to their locations by mechanical fasteners or by an appropriate permanent adhesive so as to remain permanently affixed throughout the service life of the system.
- e) Temporary labels shall be placed in label holders for ease of insertion and removal.
- f) The ETVS shall provide shielding to protect temporary labels from grease, grime, moisture, cleaning procedures, and dirt.

30.2.7.2. Size of labels.

All labels shall have a minimum character height of 0.18 inches, including descenders.

30.2.7.3. Information content of labels.

- a) The wording of labels shall be familiar to all intended readers and shall be approved by the government.
- b) Abstract symbols (such as individual letters of the alphabet, national characters, or Greek letters) shall not be used unless they have an accepted meaning to all intended readers.
- c) Abbreviations shall not be used unless they are standard terminology (e.g., “MHz”) or have meanings that are understood by all intended readers.
- d) Labels shall be as concise as possible.

30.2.7.4. Durability of labels.

- a) Labels shall be clear and distinct, and shall be mounted and protected so as to minimize obstruction by grease, grime, or dirt.
- b) Permanent labels shall remain legible throughout the service life of the system.
- c) Label markings shall be of a color that contrasts with their surroundings.

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APPENDIX D: EXTERNAL INTERFACE REQUIREMENTS

40. External interface requirements.

40.1. Description and remarks.

This appendix provides requirements for ETVS to interface with external circuits and systems.

40.2. Requirements.

40.2.1. Communications interfaces.

40.2.1.1. Analog transmission plan.

Note: The following ETVS analog transmission plan is provided to simplify the definition of the various analog interface levels by defining fixed gains and losses within the system. This means that internal system performance goals and measurements can be completely defined and expressed without reference to specific external signals such as “test tone” signals.

Throughout this specification, power levels within the ETVS are expressed in dBm0 (decibels relative to one milliwatt at the zero transmission level point); these relative measures, together with the transmission plan below, completely define the corresponding absolute measures of any signal (in decibels relative to one milliwatt or dBm) at every other point of interest within the system. Any quantity Q expressed in relative measure can be converted to absolute measure by the following formula:

$$Q \text{ (in dBm)} = Q \text{ (in dBm0)} + TL$$

where TL is the transmission level of the point of interest, obtained from the transmission plan. For example, a signal that measures -4 dBm injected at a -3 TL input point would be expressed as

$$(-4 \text{ dBm}) - (-3 \text{ TL}) = -1 \text{ dBm0}$$

This same signal appearing at a -16 TL output point would measure, in absolute terms

$$(-1 \text{ dBm0}) + (-16 \text{ TL}) = -17 \text{ dBm}$$

The same logic applies to relative and absolute measures on other bases (e.g., dBm to dBm0, dBmC to dBmC0).

In certain cases and under certain conditions identified elsewhere (e.g., A/G transmit audio compression, HS power limiting), the actual signal power provided at a system output may differ from the power that would be expected under this transmission plan.

This analog transmission plan covers only signal gains and losses within the ETVS, and is not meant to refer directly or indirectly to external circuits or to transmission plans that cover them (i.e., ETVS OTLP is not necessarily the telephone company OTLP).

- a) All analog communications interfaces of the ETVS shall conform to the following uniform transmission plan. The transmission level (TL) at each point specified below is the imputed fixed gain between that point and the defined zero transmission level point.
- b) The input from the HS microphone element (at the point of connection to the ETVS) is defined as the reference zero transmission level point (OTLP) for the ETVS and shall therefore be at 0 TL.
- c) The analog communications inputs and outputs shall be at the respective transmission levels shown in figure 40-1.
- d) For purposes of site adaptation, the ETVS shall permit the transmission level of certain interface points to be raised or lowered in accordance with Appendices F and H.

40.2.1.2. Audible call progress tones.

Call progress tones (e.g., dial tone, busy tone, ringback tone) required by the ETVS shall be in accordance with EIA/TIA-464A-1, paragraph 4.7, with the following exceptions:

- a) Reorder Tone cadence and tolerance:
 - 1) OFF 250 ms +25/-50 ms (range of 200 to 275 ms)
 - 2) ON 250 ms +25/-50 ms (range of 200 to 275 ms)
- b) At each operational position, the ETVS shall supply the following tone levels:

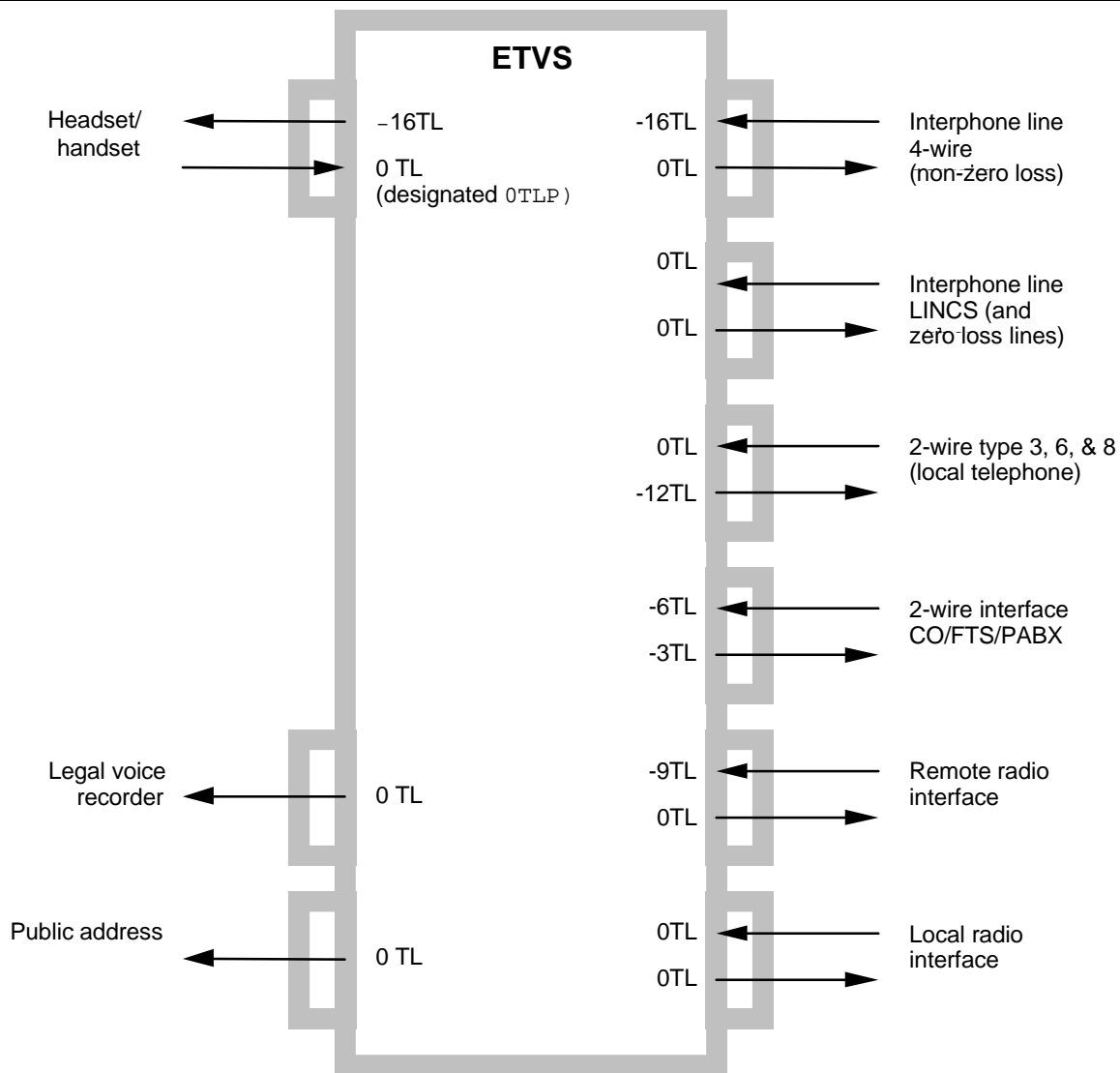


Figure 40-1 Analog transmission plan illustration

- 1) Dial tone and zip tone (combined 350 Hz and 440 Hz tones): -9 dBm0 to -10 dBm0 combined;
- 2) Reorder and busy tone (combined 480 Hz and 620 Hz tones): -19 ± 1.5 dBm0 per frequency; and
- 3) Audible ring tone (combined 440 Hz and 480 Hz tones): -15 ± 1.5 dBm0 per frequency.

40.2.1.3. Numbering plan.

- a) At each site requiring address signaling to direct calls to individual positions, the ETVS shall operate according to an individual numbering plan.

- b) The ETVS numbering plan shall be compatible with that of the system it has replaced, so that remote stations do not have to revise address signaling procedures or directories.
- c) The ETVS numbering plan for all trunk/circuit types shall facilitate mission reconfiguration as specified in 10.3.7.1.10.

40.2.1.4. Radio equipment.

The ETVS shall interface to local and remote radio equipment in accordance with Appendix H of this specification, in quantities per site and configurations to be defined at time of order.

40.2.1.5. Remote frequency preemption and frequency interlock trunk.

The ETVS shall interface to government-furnished four-wire E&M trunks and four-wire tone-on-active trunks, for remote frequency preemption or frequency interlock, in accordance with Appendix F of this specification and in quantities and configurations to be identified at time of order.

40.2.1.6. Analog IP G/G circuits.

The ETVS shall interface with G/G circuits in accordance with Appendix F of this specification, in quantities per site and configurations to be defined at time of order.

40.2.1.7. Administrative telephone system (ATS).

Note: The ETVS may be required to connect to administrative telephones (PABX, key system, etc.) to place and receive inside (i.e., within the facility) and outside (i.e., on public networks) calls.

- a) The ETVS shall interface to the government furnished ATS.
- b) The ETVS shall emulate a type-2500 telephone instrument in accordance with EIA/TIA-464A-1 and shall provide either DTMF or dial pulse signaling as directed at time of order.
- c) If the ATS is of the key or hybrid key types, the ETVS shall emulate an off-premises station (OPS).
- d) The ETVS shall provide a recorder warning tone to ATS callers.

40.2.1.8. Telephone networks.

- a) The ETVS shall interface to the following telephone networks, emulating a type-2500 telephone instrument in accordance with EIA/TIA-464A-1 and supporting either DTMF or dial pulse signaling as directed at time of order.
 - 1) Public switched telephone network (PSTN);
 - 2) Federal telecommunications system (FTS);
 - 3) Defense switched network (DSN).

- b) The ETVS shall provide a periodic recorder warning tone to callers on such networks.

40.2.1.9. Public address system.

The ETVS shall interface to government-furnished public address systems in accordance with Appendix F of this specification, in quantities and configurations to be defined at time of order.

40.2.1.10. ATIS recorders.

The ETVS shall interface to government-furnished ATIS recorders in accordance with Appendix F of this specification, in quantities and configurations to be defined at time of order.

40.2.1.11. Trunk grouping.

The ETVS shall provide trunk grouping and directionalization features for analog G/G circuits having supervisory signaling and either incoming, outgoing, or both address signaling as follows:

- a) The ETVS shall provide trunk groups having as few as two trunks.
- b) The ETVS shall permit each trunk group to be classmarked as one of the following:
 - 1) Incoming: The ETVS shall provide answer supervision on these trunks, and these trunks shall not be used to place outgoing calls.
 - 2) Outgoing: The ETVS shall provide outgoing call supervision and shall not recognize any incoming calls.
 - 3) Two-way: The ETVS shall both answer incoming calls and permit outgoing calls to be placed.
- c) For government trunks where call signaling does not provide call type information (i.e., override or routine call), the ETVS shall permit each such trunk to be classmarked as processing either override or routine calls.
- d) The ETVS shall use an idle line hunting algorithm that distributes outgoing calls evenly over all trunks in outgoing or two-way trunk groups.
- e) The ETVS shall provide access to trunk groups via IA or DA procedures as defined in Appendix A.

- f) Trunk grouping and classmark assignments shall be set through the system expansion and physical reconfiguration procedures in 10.3.8.
- g) All trunks within a trunk group shall support identical features.

40.2.2. Legal voice recording system.

- a) The ETVS shall interface to the legal voice recording system at a government-provided distribution frame or demarcation point.
- b) Signals furnished to the legal voice recording system by the ETVS shall have the following characteristics:
 - 1) Interface impedance of 600 ohms nominal, balanced and isolated from ground;
 - 2) Signal level in accordance with the uniform analog transmission plan (paragraph 40.2.1.1).

40.2.3. Operator equipment.

40.2.3.1. Headsets.

- a) ETVS headsets shall be Plantronics HSB-311 or equivalent for non-noise canceling over-the-ear headset assemblies (color to be approved by the government).
- b) Reserved
- c) ETVS headsets shall be furnished with a lower cable assembly of 10 or 25 feet fully extended length, as specified at time of order.

40.2.3.2. Handsets.

- a) The ETVS shall provide noise-canceling and non-noise-canceling handsets as specified at time of order.
- b) Noise-canceling ETVS handsets shall comply with FAA-E-2603A for "G" style handset assemblies with the exception of paragraph 3.3.5 (color to be approved by the government).

- c) Non-noise-canceling ETVS handsets shall comply with FAA-E-2603A for "G" style handset assemblies with the exception of paragraphs 3.3.5 (color to be approved by the government) and 3.5.
- d) ETVS handsets shall be furnished with a lower cable assembly of 10 or 25 feet fully extended length, as specified at time of order.

40.2.3.3. Footswitches.

- a) The ETVS shall be provided with Linemaster 635-S footswitches or equivalent approved by the government.
- b) ETVS footswitches shall be furnished with a cable assembly of at least 10 feet fully extended length.

40.2.4. Door release.

As directed at time of order, the ETVS shall provide momentary contact closures rated at a minimum of 1 ampere at 120 V ac or 2 amperes at 30 V dc to operate government-furnished door unlock solenoids.

40.2.5. Power.

- a) The ETVS central equipment shall interface with government-furnished ac electrical power which may be from either the ac mains or from government-supplied uninterruptible power supplies. The power requirements of the ETVS are specified in appendix E, 50.2.
- b) The ETVS shall supply power to operate all positions.
- c) Reserved.

40.2.6. ETVS distribution panel.

The ETVS shall provide intermediate distribution panels as required for the connection of external interfaces.

APPENDIX E: PHYSICAL DESIGN REQUIREMENTS

50. Physical design requirements.

50.1. Description and remarks.

This appendix provides the physical (electrical and mechanical) design requirements that apply to all ETVS equipment (unless otherwise noted).

50.2. Electrical requirements.

50.2.1. Electric power.

- a) Government-furnished power will have a nominal line frequency of 60 Hz, with the following voltages and phases available to the ETVS as required:
 - 1) 120 Vac nominal, single phase;
 - 2) 240 Vac nominal, single phase; and,
 - 3) 208 Vac nominal, three phase.
- b) The ETVS equipment shall perform fully in accordance with this specification when furnished AC power that varies by as much as 10% from nominal line voltage, and by as much as 5% from nominal frequency.
- c) The ETVS shall not sustain damage to or alteration of equipment, nor cause false operation or false output, when ac power outside the limits above is furnished for operation, including total loss of power.
- d) The ETVS shall sustain transient AC power interruptions of up to 500 ms without degradation or interruption of operations.

Note: If proper operations cannot be maintained during out-of-spec power conditions, the ETVS should cease to operate at all rather than operate in a misleading manner.

- e) The ETVS shall meet power source requirements of 3.1.2.4 in FAA-G-2100F.
- f) The ETVS shall draw no more than 600 VA of AC power per installed position under any load condition (this figure includes an allocation for backroom and support equipment).

50.2.2. Power distribution.

The power distribution design and implementation shall be in accordance with National Electric Code, NFPA-70, and FAA-C-1217E.

50.2.3. Reserve power supply.

- a) As ordered by the government, the ETVS shall provide a reserve power supply to permit the system to continue operations without performance degradation for a period of at least 20 minutes of continuous out-of-spec power conditions (e.g., outages, brownouts or sags, loss of phases, overvoltages, etc.) at a traffic load at least as great as the communications test load (4.3.7).
- b) The reserve power system shall provide power for supervisory workstations as well as for local (i.e., non-remoted) maintenance workstations.
- c) The ETVS shall not suffer service interruptions during transitions between main and reserve power.
- d) The ETVS shall provide visible and momentary audible alarms at the supervisory and maintenance positions and other locations to be identified at the time of order to indicate each transition to reserve power.
- e) The ETVS shall provide continuous visible and momentary audible alarms at the supervisory and maintenance positions and other locations to be identified at the time of order whenever the power remaining in the reserve power system is insufficient for more than five minutes of continued operation, as measured on newly built and configured fully loaded systems.
- f) The reserve power supply shall not vent hazardous or corrosive gases into the atmosphere.
- g) After restoration of main power, the reserve power supply shall be recharged at a sufficient rate such that it is available for full service (i.e., 20 minutes of power) within 2 hours of a condition resulting from 50.2.3.a.

- h) Upon restoration of main AC power after total depletion of the reserve power supply, the ETVS shall restart automatically without requiring any operator intervention (e.g., to activate power switch, load software, or reset processors).
- i) Operation of the ETVS shall not be degraded while the reserve power is partially or fully discharged, provided main AC power is within tolerances of 50.2.1 is available (i.e., as long as normal ac power is available, system can operate without batteries or with depleted batteries).

50.2.4. Grounding systems.

- a) The government will furnish a multi-point earth ground and an ac power ground at all installations.
- b) The ETVS grounding system shall prevent cross-coupling through the ground system.
- c) The ETVS shall use centrally located grounding to prevent ground loops and shared impedance-coupling paths.
- d) The ETVS shall use separate grounding networks as necessary for the following:
 - 1) ac power ground;
 - 2) Chassis ground;
 - 3) Signal ground;
 - 4) Trunk circuit ground.
- e) These grounding networks shall be terminated on a grounding terminal block for either strap connection and/or further connection to the earth, ac, and signal grounds.
- f) Grounding shall be in accordance with 3.11 of FAA-STD-019B and 3.8 of FAA-STD-020B.

50.2.5. Lightning protection.

The ETVS shall be protected against high voltage damage and shall provide lightning surge protection of equipment interfacing with external transmission facilities and AC power in accordance with FAA-STD-020B.

50.3. Mechanical requirements.

50.3.1. Module removal and insertion.

- a) The ETVS shall permit removal of all modules and printed circuit assemblies without causing damage to the modules, printed circuit assemblies, or any other equipment.
- b) The ETVS shall permit the removal or insertion of each module while system power is on without damage to equipment or interruption of service to the operator on remaining modules. Mechanical interlocks or keyed elements may be used to disconnect power temporarily from modules or components during removal or insertion.
- c) The ETVS shall use mechanical means (interlocks or keys) to prevent insertion or connection of plug-in modules that are incorrectly oriented.
- d) When redundant modules are incorporated into a design or when a radio frequency interface having separate connections to a main/standby transmitter or receiver is ordered, the ETVS shall permit the removal of one of the redundant modules or removal of either main or standby radio interface without interruption of service to an operator on remaining modules.

50.3.2. Printed circuit assemblies.

- a) Terminology and definitions shall be in accordance with ANSI IPC-T-50.
- b) Alignment, where required, shall be possible using standard tools.
- c) Alignment adjustments shall be accessible without disassembly of the printed circuit assembly.
- d) Printed circuit assemblies shall be manufactured in accordance with paragraph 3.2.2.1.4 of FAA-G-2100F.
- e) The use of wire wrap on printed circuit boards is prohibited.

50.3.3. Cabinet and frame requirements.

50.3.3.1. Cabinet and frame construction.

- a) The equipment room cabinets and frames shall not exceed a height of 72 inches (1.83 meters), a

width of 36 inches (0.91 meters), and a depth of 30.5 inches (0.76 meters).

- b) The loading conditions of each fully equipped cabinet and frame shall not exceed an average weight distribution greater than 125 lb/ft².
- c) The structural strength and rigidity of the cabinets, frames, and consoles shall be such that normal handling in loading, shipping, unloading, and setting into position for installation will not result in any damage to the equipment. Removable equipment cabinet or frame-lifting devices (hooks, rings, etc.) may be installed for convenience to facilitate handling and installation.
- d) Removal of equipment or modules or interchanging of equipment modules shall not cause any deformation to the cabinets and frames.
- e) Structural strength and rigidity of all cabinets shall be independent of any strength or rigidity provided by access doors.
- f) Removable components shall not exceed the weight limits specified below so as to permit removal and replacement by one person:
 - 1) For components up to 3 feet from the floor, 40 pounds.
 - 2) For components between 3 feet and 5 feet from the floor, 33 pounds.
- g) The ETVS shall not place any equipment, other than small parts or miscellaneous hardware, above 5 feet from the floor.

50.3.3.2. Cabinet and frame rewiring.

- a) Each ETVS shall be provided with cabinet space, card racks, and wiring to allow for future expansion up to the maximum size required for each base system defined in Appendix O.
- b) All cabinet wiring shall be provided with chafing protection in addition to the individual wire or cable insulation jackets.
- c) Cable grounding shall be in accordance with FAA-STD-020B.

50.3.3.3. Cabinet and frame convenience outlets.

- a) The ETVS shall provide at least two ac convenience outlets for each cabinet or frame (i.e., for use by technicians to power tools, test equipment, etc. during maintenance operations).
- b) The ac convenience outlets shall be independent of the primary power source for the equipment within the cabinets and frames, and in accordance with 3.1.2.2.7 of FAA-G-2100F.

50.3.3.4. Cable entrance and exit.

- a) The ETVS shall provide access for interconnecting cables to enter through the top and bottom of the equipment cabinet.
- b) Direct cabling through the side walls of cabinets, at least 6 inches above the floor, may be used within a subsystem where distance is considered a critical factor in circuit performance. Direct cabling shall not preclude installation of additional frames, card cages, or other such items that may be required for future expansion of the ETVS as provided in Appendix O.

50.3.3.5. Distribution panels.

- a) The ETVS shall be provided with a distribution panel to facilitate the interconnection of all cables to the government equipment distribution frame(s).
- b) The ETVS distribution panel shall accommodate all interface requirements.
- c) Cables shall be provided to interconnect the distribution panel to the government equipment distribution frame(s), panels, or junction boxes.
- d) ETVS distribution panels shall accommodate the wired for capacity of the basic system ordered for the site.
- e) Protector frames shall be provided as required by FAA-STD-020.

50.3.3.6. Ventilation and cooling.

- a) Each cabinet requiring forced ventilation shall contain its own silent fan blower system, and shall require no external ducts.

- b) The ETVS equipment shall not malfunction with access doors and plates open, and drawers extended for servicing, for up to 8 consecutive hours.
- c) The ETVS shall take in air from the bottom of the cabinet.
- d) The ETVS cabinet shall allow air intake from either below a raised floor or from floor level, by simple removal of cover plates or baffles.
- e) Air intakes shall be provided with uniform air filters in accordance with 3.1.3.5.1 of FAA-G-2100F in all equipment cabinets with filters to be replaceable using only common hand tools.
- f) Ventilation exhaust openings shall be through the top of the cabinet and shall direct the exhaust upward and away from personnel and other equipment.
- g) Exhaust outlet openings shall not interfere with or be obstructed by cable routing.
- h) For position equipment where fans are incorporated into the design, the position shall provide an indication of the failure of the fan module.
- i) For each cabinet requiring forced ventilation, the ETVS shall report to the maintenance function any condition that would cause a ventilation problem (e.g., blower failure, clogged filters).

50.3.3.7. Overheat warning.

- a) The ETVS shall provide warning devices in each separate cabinet to indicate when the temperature exceeds the maximum safe operating temperature for the equipment within the cabinet.
- b) The ETVS shall provide a visual indication of overheating for each cabinet, readily visible from the front cabinet exterior.
- c) The ETVS shall provide a visible and momentary audible alarm at the supervisory and maintenance positions and other locations to be designated at time of order, whenever cabinets overheat.

50.3.4. Interconnection cables.

- a) All interconnection cables and connectors required for factory testing, equipment site

installation, checkout, acceptance testing, cutover, operation, and maintenance shall be compatible with both underfloor and overhead distribution and cable facilities provided by the government.

- b) All such cabling shall permit accessibility to equipment for test maintenance and replacement.
- c) Cabling and wiring shall comply with 3.3.1.3.4.26 of FAA-G-2100F; National Electric Code, NFPA-70; and FAA-C-1217E.
- d) All interconnecting cables shall be plenum-rated in accordance with NFPA-70 725-38 and 800-53.

50.3.4.1. Cable connectors.

- a) All cable connectors furnished on the equipment for making external connections shall be clearly identified on the plug-in side by labels descriptive of their specific function and by the proper reference designation.
- b) Cable connectors shall be mechanically keyed to prevent incorrect installation and hookup.
- c) The mating connector part (connector or plug) that is electrically energized shall contain female contacts.
- d) All cable connectors shall be mechanically retained in place.

50.3.4.2. Cable-end terminations.

- a) Signal cable end terminations shall be solderless, quick-disconnect terminal blocks or mass termination connectors. Connectors that have insert-type contacts may be loaded with only the contacts actually used plus spares.
- b) Power cable terminations shall be screw-type terminal blocks, pressure contact terminal blocks, or connectors.

50.3.4.3. Power cables.

- a) All ac power cables and wiring within the ETVS shall be isolated from sensitive voice and signaling circuits.
- b) Cabling shall include all junction boxes, fittings, and distribution equipment (switches and circuit

breakers from government power source to the ETVS primary power panel).

50.3.5. Nameplates and product marking.

Identification of ETVS units shall be in accordance with FAA-G-2100F, paragraph 3.3.3, with the exception of paragraph 3.3.3.1.

50.3.6. Materials.

Selection of materials shall be consistent with the requirement of economically producing a system that performs its specified functions with ruggedness and durability.

50.3.6.1. Recycled material.

- a) All electrical, electronic, or electromechanical parts used in the ETVS shall be new.
- b) Recycled metals or plastics may be used for mechanical or structural parts as appropriate.

50.3.6.2. Toxicity.

The ETVS shall be constructed from materials of low toxicity, not having dangerous gasses due to fires or toxic effects when used under specified environmental conditions for operating and non-operating equipment (see 50.9).

50.3.6.3. Glass.

All glass used in the equipment shall be shatterproof, clear, and free of distortion at all viewing angles.

50.3.6.4. Fungus.

The materials chosen shall be non-nutrient to fungus and insects, flame resistant, non-hygroscopic, and not adversely affected by the environmental conditions specified herein.

50.3.6.5. Plastics.

Transparent plastics used in displays, selectors, backlighting, and related applications shall not warp, soften, discolor, or otherwise be degraded in appearance or physical properties due to heat buildup encountered in normal operation.

50.3.7. Color and finishes.

All equipment racks and cabinets shall be fully painted on all exterior surfaces and corrosion protected on all interior surfaces (painting permitted). All surfaces shall be prime painted in a neutral color. The finish shall be a baked enamel paint or equivalent. All exterior surfaces shall be free from burrs and sharp edges.

50.4. Electronic equipment assembly requirements.

ETVS electronic equipment shall be assembled in accordance with 3.2.2.1 of FAA-G-2100F.

50.5. Interchangeability.

All assemblies, subassemblies, and replaceable parts of the ETVS that are intended to be identical in function, use, or application shall be fully mechanically and electrically interchangeable regardless of manufacturer or supplier.

50.6. Selection of components, subsystems, and supplies.

- a) The government encourages the use of commercial off-the-shelf components, subsystems, and supplies in the construction of the ETVS (e.g., for workstations, data storage, printing, recording etc.) as a means to reduce the supplier's risk and to provide flexible future support options for the government. Wherever used, such items shall not be modified so as to render them irreplaceable through commercial channels, unless such modification is essential for the fulfillment of other requirements.
- b) The ETVS shall be constructed of components and subsystems selected with attention to the service life and long-term support requirements of the contract of which this specification forms a part.

50.7. Government-furnished property usage.

The ETVS shall not require the use of government-furnished property except as indicated in this specification.

50.8. Safety.

System safety engineering principles shall apply in accordance with 3.3.6 of FAA-G-2100F.

50.9. Environmental endurance.

The ETVS shall operate in all combinations of environmental conditions specified below. Operating conditions apply under all fixed or slowly varying conditions of ac voltage and frequency defined in 3.2.1.3 of FAA-G-2100F. Non-operating conditions, for which the environment is uncontrolled, include shipping and handling, storage, and facilities not in service.

50.9.1. Operating environment.

The ETVS shall suffer no degradation in performance when operated within the following conditions, and under all fixed and slowly-varying conditions of ac voltage defined in 3.2.1.3 of FAA-G-2100F.

- a) Operational temperature range: 10 to 40°C;
- b) Relative humidity: 10% to 80% non-condensing;
- c) Altitude: up to 10,000 feet above sea level;
- d) Maximum temperature gradient: 8.3 °C per hour.

50.9.2. Nonoperating environment.

The ETVS shall suffer no damage when stored, transported, or left idle (without power) under the following conditions:

- a) Temperature range: -20 to +70° C;
- b) Relative humidity: 0% to 100% including condensation;
- c) Altitude: up to 50,000 feet above sea level.

50.10. Solar radiation.

Exposure to solar radiation in the tower cab shall not cause degradation of appearance of ETVS or failure by ETVS to meet all functional and performance requirements.

50.11. Electromagnetic compatibility.

- a) No system delivered under this specification shall cause electromagnetic interference with, or be affected by electromagnetic interference from, the site at which it is installed.

Note: “Electromagnetic interference” means any failure by ETVS to meet the functional and performance requirements of this specification, or impairment by ETVS of other systems’ performance, due to electromagnetic radiation.

- b) All ETVS equipment shall be compliant with CFR 47, Chapter 15.
- c) All ETVS equipment to be installed within the tower cab shall meet MIL-STD-461D requirement RS103 for ground based platforms using the Navy/Air Force criteria up to 1 gigahertz (GHz).
- d) All ETVS equipment to be installed within the tower cab shall pass radar pulse susceptibility testing as set forth in section 4.3.3.3.

50.12. Electrostatic discharge immunity.

Note: “Electrostatic discharge” refers to the sudden transfer of static electric charge (built up through mechanical friction or other means) between the ETVS and external entities (including personnel), or within the ETVS.

- a) The ETVS shall incorporate protection against damage or disruption arising from electrostatic discharge from personnel using or servicing the ETVS.
- b) The ETVS shall pass electrostatic discharge testing as set forth in section 4.3.4.

APPENDIX F: ANALOG GROUND/GROUND COMMUNICATIONS INTERFACES

60. Analog G/G communications interfaces.

60.1. Description and remarks.

This appendix defines the interface requirements between the ETVS and certain existing analog G/G trunks and circuits.

The government expects most of the circuits to be terminated at the ETVS to be full-period dedicated lines in two-point and multipoint configurations. The ETVS must be able to operate with the variety of signaling and supervision protocols employed by these lines.

60.2. Requirements.

The ETVS shall, as ordered by the government, provide interfaces conforming to each of the circuit and trunk types listed in Table 60-1.

60.2.1. Audio type.

The ETVS shall provide two-wire and four-wire interfaces.

60.2.2. Incoming call signaling.

- a) The ETVS shall accept the following incoming call signaling as required for the circuits and trunks in table 60-1.
- b) In some cases, more than one type of incoming call signaling will be provided by the circuit or trunk; the ETVS shall accept all of these types.

60.2.2.1. 20 Hz ring.

The ETVS shall detect 20 Hz incoming ring voltage in accordance with EIA/TIA-464A-1, paragraph 4.1.2.2.

60.2.2.2. Loop start detection.

The ETVS shall detect loop start conditions initiated at the distant end of the circuit or trunk in accordance with EIA/TIA-464A-1, paragraph 4.1.3.3.

60.2.2.3. Voice page.

The ETVS shall detect the presence and absence of audio signals transmitted from the distant end of the circuit or trunk in accordance with 20.2.4.9.

60.2.2.4. E-lead.

The ETVS shall detect Type I and Type II E-lead closures, as defined in EIA/TIA-464A-1, paragraph 4.2.3, initiated at the distant end of the circuit or trunk.

60.2.2.5. Single frequency.

The ETVS shall detect the presence and absence of single frequency tones transmitted from the distant end of the circuit or trunk in accordance with the following signal conventions.

- a) Tone on idle - Detect and process 2600 Hz SF in accordance with AT&T PUB 43201A, Appendix A, paragraph 3.0.
- b) Tone on idle - Detect and process 2400 Hz SF in accordance with AT&T PUB 43201A, Appendix A, paragraph 3.0 using the following criteria:
 - 1) Valid single frequency tone within the 2400 \pm 7 Hz band,
 - 2) The receiver shall reject a 2350 Hz and 2450 Hz tone when applied from -37 to -1 dBm0 level, and
 - 3) The band elimination filter shall have an insertion loss of at least 50 dB from 2385 to 2415Hz.
- c) Tone on active - Detect 2600 Hz SF in accordance with AT&T PUB 43201A, Appendix A, paragraph 3.0 excluding subparagraph 3.07, and process SF calls in accordance with this citation except that the on-hook state is defined as the absence of SF tone, and off-hook state is defined as the presence of SF tone.
- d) Tone on active - Detect 2400 Hz SF in accordance with AT&T PUB 43201A, Appendix A, paragraph 3.0 as modified in b), excluding subparagraph 3.07, and process SF calls in accordance with this citation except that the on-hook state is defined as

Audio Type	Incoming Service	Incoming Signaling	Incoming Procedure	Outgoing Service	Outgoing Signaling	FAA design.
2W	20 Hz ring	60.2.2.1	10.3.2.2.6	Loop start	60.2.3.1	3
2W	20 Hz ring	60.2.2.1	10.3.2.2.6	Ground start	60.2.3.2	3
2W	20 Hz ring	60.2.2.1	10.3.2.2.6	Loop + dial	60.2.3.1/60.2.3.9	6
2W	20 Hz ring	60.2.2.1	10.3.2.2.6	Ground + dial	60.2.3.2/60.2.3.9	6
2W	20 Hz ring	60.2.2.1	10.3.2.2.6	Voice	60.2.3.5	3
2W	Loop start	60.2.2.2	10.3.2.2.6	20 Hz Auto	60.2.3.3	3
2W	Loop start	60.2.2.2	10.3.2.2.6	20 Hz Man	60.2.3.4	3
2W	Loop start (as VOX)	60.2.2.2	10.3.2.2.2	20 Hz. Auto	60.2.3.3	3
2W	Loop start (as VOX)	60.2.2.2	10.3.2.2.2	20 Hz. Man	60.2.3.4	3
2W	Voice (as loop start)	60.2.2.3	10.3.2.2.2	20 Hz. Man	60.2.3.4	3
2W	Voice	60.2.2.3	10.3.2.2.2	Voice	60.2.3.5	9
2W	Loop start (as VOX)	60.2.2.2	10.3.2.2.2	Voice	60.2.3.5	9
2W	Loop + dial	60.2.2.2/60.2.2.9	10.3.2.2.5	20 Hz Auto	60.2.3.3	8
2W	Loop + dial	60.2.2.2/60.2.2.9	10.3.2.2.5	20 Hz Man	60.2.3.4	8
2W	None	N/A	N/A	Voice	60.2.3.5	(#)
2W	Voice	60.2.2.3	N/A	None	N/A	(##)
4W	Voice	60.2.2.3	10.3.2.2.2	Voice	60.2.3.5	9
4W	20 Hz ring	60.2.2.1	10.3.2.2.6	20 Hz Man	60.2.3.4	3
4W	20 Hz ring	60.2.2.1	10.3.2.2.6	Loop	60.2.3.1	3
4W	20 Hz ring	60.2.2.1	10.3.2.2.6	Loop + dial	60.2.3.1/60.2.3.9	6
4W	SS dial	60.2.2.9	10.3.2.2.4	SS dial	60.2.3.9	4
4W	SS dial	60.2.2.9	10.3.2.2.4	Voice	60.2.3.5	5
4W	Voice	60.2.2.3	10.3.2.2.2	SS dial	60.2.3.9	5
4W	SS dial	60.2.2.9	10.3.2.2.4	SS dial or voice	60.2.3.5/60.2.3.9	4/5
4W	E-lead	60.2.2.4	10.3.2.2.6	M-lead	60.2.3.6	3*
4W	Tone-on-idle	60.2.2.5	10.3.2.2.6	Tone-on-idle	60.2.3.7	3
4W	Tone-on-active	60.2.2.5	10.3.2.2.6	Tone-on-active	60.2.3.7	3
4W	Tone-on idle/dial	60.2.2.5/60.2.2.9	10.3.2.2.5	Tone-on-idle + dial	60.2.3.7/60.2.3.9	7, 20
4W	E-lead + dial	60.2.2.4/60.2.2.9	10.3.2.2.5	M-lead + dial	60.2.3.6/60.2.3.9	7, 20

* May be used as remote frequency preemption trunk or remote interlock trunk.
One-way; may be used for public address, ATIS output, or legal recorder connection.
One-way; may be used for ATIS input.

Table 60-1: ETVS analog circuit interface types

the absence of SF tone, and off-hook state is defined as the presence of SF tone.

Note: PUB 43201 assumes a +/-16 TL interface; absolute power measurements must be translated to the ETVS TL of the circuit or trunk under consideration.

60.2.2.6. Selective signaling (SS dial).

- The ETVS shall accept selective signaling tone bursts transmitted from the distant end of the circuit or trunk.
- The ETVS shall detect selective signaling tones from the distant end of the circuit or trunk in accordance with requirements defined in FAA-STD-054 Table 3-2.

60.2.2.7. Reserved

60.2.2.8. Ring trip detection.

The ETVS shall detect call answer in presence of outgoing ring per 60.2.3. in accordance with EIA/TIA-464A-1, paragraph 4.5.4 and 4.5.5.

60.2.2.9. Receiving dial.

The ETVS shall receive and process address signaling provided by trunks and circuits in accordance with the following and as ordered by the government:

- a) Dual tone multi frequency (DTMF)—Accept DTMF address digits using receivers meeting type I receiver characteristics in EIA/TIA-464A-1, paragraphs 4.6.2.3, 4.6.2.4, and 4.6.2.6.
- b) Dial pulse—Accept dial pulse address signaling from the following interfaces:
 - 1) Loop start (telephone)—Accept dial pulse digits from the telephone instrument meeting requirements in EIA/TIA-464A-1, paragraph 4.6.1.2.;
 - 2) CO/PABX—Accept dial pulse address digits from the CO or PABX trunk in accordance with EIA/TIA-464A-1, paragraph 4.1.3.4, using immediate dial supervision;
 - 3) E&M—Accept dial pulse address digits from E&M interfaces in accordance with EIA/TIA-464A-1, paragraph 4.2.3.5.1.;
 - 4) Tone on idle SF—Accept dial pulse digits from SF interfaces in accordance with E&M procedures defined in 60.2.2.4, where E-lead active (off-hook) is absence of tone, and E-lead release (on-hook) is presence of tone;
 - 5) Tone on active SF—Accept dial pulse digits from SF interfaces in accordance with E&M procedures defined in 60.2.2.4, where E-lead active (off-hook) is presence of tone, and E-lead release (on-hook) is absence of tone; and,
 - 6) SS—Accept dial pulse digits from SS interfaces in accordance with selective signaling in 60.2.2.6.

60.2.3. Outgoing call signaling.

- a) The ETVS shall initiate the following outgoing call signaling as required for the circuits and trunks in table 60-1.
- b) In some cases, more than one type of outgoing call signaling is required for a particular circuit or trunk type; the ETVS shall initiate any of these depending upon the manner in which the call is placed.

60.2.3.1. Loop start.

The ETVS shall initiate loop start upon seizure of the idle circuit by the operator in accordance with EIA/TIA-464A-1, paragraph 4.1.2.4.

60.2.3.2. Ground start.

The ETVS shall initiate ground start upon seizure of the idle circuit by the operator in accordance with EIA/TIA-464A-1, paragraph 4.1.1.4.

60.2.3.3. 20 Hz automatic ring.

- a) The ETVS shall provide 20 Hz outgoing ring voltage (as designated by the government) automatically upon seizure of the idle circuit by the operator in accordance with EIA/TIA-464A-1.
- b) Reserved.

60.2.3.4. 20 Hz manual ring.

The ETVS shall provide 20 Hz outgoing ring voltage (as designated by the government) in accordance with EIA/TIA-464A-1 upon activation by the operator of a manual ring selector on circuits previously seized by the operator.

60.2.3.5. Voice page.

The ETVS shall transmit voice from the operator's HS into the circuit as it is received.

60.2.3.6. M-lead.

The ETVS shall initiate Type I and Type II M-lead closure as defined in EIA/TIA-464A-1, paragraph 4.2.3.

60.2.3.7. Single frequency.

The ETVS shall provide single frequency (SF) signaling in accordance with the following signaling conventions:

- a) Tone on idle - Transmit and process 2600 Hz SF in accordance with PUB 43201A, Appendix A, paragraph 2.0 except that the transmit tone power shall be $-20 \text{ dBm}_0 \pm 1 \text{ dB}$ at all times.
- b) Tone on idle - Transmit and process 2400 Hz SF in accordance with PUB 43201A, Appendix A, paragraph 2.0 with the following criteria:
 - 1) The SF frequency shall be $2400 \pm 4 \text{ Hz}$, and
 - 2) The transmit tone power shall be $-20 \text{ dBm}_0 \pm 1 \text{ dB}$ at all times.
- c) Tone on active - Transmit 2600 Hz SF in accordance with a) except that the on-hook state is defined as the absence of SF tone, and off-hook state is defined as the presence of SF tone.
- d) Tone on active - Transmit 2400 Hz SF in accordance with b) except that the on-hook state is defined as the absence of SF tone, and off-hook state is defined as the presence of SF tone.

Note: PUB 43201 assumes a $+7/-16 \text{ TL}$ interface; absolute power measurements must be translated to the ETVS TL of the circuit or trunk under consideration.

60.2.3.8. Selective signaling (SS dial).

- a) The ETVS shall provide SS-4 selective signaling tones corresponding to station numbers dialed by the operator in accordance with 10.3.2.2.4, and meeting the requirements defined in FAA-STD-054 Table 3-2.
- b) The ETVS shall mute transmit audio output for the duration of each SS dial digit sent on a SS dial circuit.

60.2.3.9. Sending dial.

The ETVS shall send address signaling to trunks and circuits in accordance with the following and as ordered by the government:

- a) Dual tone multi frequency (DTMF)–Generate DTMF address digits using generators meeting

characteristics in EIA/TIA-464A-1, paragraphs 4.6.2.3 and 4.6.2.5.

- b) Dial pulse–Generate dial pulse address signaling into the following interfaces:
 - 1) Loop start and ground start–Provide dial pulse address signaling to the line or trunk in accordance with EIA/TIA-464A-1, paragraph 4.6.1.;
 - 2) E&M–Send dial pulse address digits into E&M interfaces in accordance with EIA/TIA-464A-1, paragraph 4.2.3.4.1.;
 - 3) Tone on idle SF–Send dial pulses to SF interfaces in accordance with E&M procedures defined in 60.2.3.6, where M-lead active (off-hook) is absence of tone, and M-lead release (on-hook) is presence of tone;
 - 4) Tone on active SF–Send dial pulses to SF interfaces in accordance with E&M procedures defined in 60.2.3.6, where M-lead active (off-hook) is presence of tone, and M-lead release (on-hook) is absence of tone;
 - 5) SS–Send dial pulse digits to SS interfaces in accordance with selective signaling in 60.2.3.8.; and,
 - 6) CO/PABX–Send dial pulse digits to CO/PABX interfaces in accordance with EIA-TIA-464A-1, paragraph 4.1.2.4.

60.2.4. FAA type designation.

Common FAA type designations for analog circuits and trunks are provided in Table 60-1 for reference.

60.2.5. Applicable call procedures.

- a) The ETVS shall follow the procedures listed in table 60-1 and defined in 10.2.3 for processing incoming and outgoing calls on analog circuits and trunks.
- b) In some cases, more than one call procedure is applicable to the trunk or circuit type; the ETVS shall follow one or more of them as designated by the government.

60.2.5.1. Ringdown interphone.

The ETVS shall place and accept ringdown IP calls as specified in 10.3.2.1 and 10.3.2.2.1.

60.2.5.2. Selective interphone.

The ETVS shall place and accept selective IP calls as specified in 10.3.2.1 and 10.3.2.2.4.

60.2.5.3. Voice call.

The ETVS shall place and accept voice calls as specified in 10.3.2.1, and 10.3.2.2.2.

60.2.5.4. Other call types.

- a) The ETVS shall place and accept external network calls as specified in 10.3.2.1 and 10.3.2.2.5.
- b) As ordered by the government, the ETVS shall provide outgoing dial pulse or dual-tone multi frequency (DTMF) dialing corresponding to numbers dialed by the operator.

60.2.6. Audio transmission requirements.

60.2.6.1. ETVS-to-trunk requirements.

For transmission from the ETVS to trunks or circuits balanced to ground with ground isolation,

- a) The ETVS shall transmit into an assumed nominal impedance of 600 ohms for two-wire and four-wire trunks and circuits, with an option of 900 ohms for two-wire trunks and circuits.
- b) The ETVS shall transmit at the appropriate power level for the trunk or circuit as given in the analog transmission plan (paragraph 40.2.1.1).
- c) For site adaptation, the ETVS shall provide a range of adjustment of output power level between +12 and -16 dB relative to the level at the zero transmission level point specified in the analog transmission plan, and shall permit qualified government personnel to make this adjustment.

60.2.6.2. Trunk-to-ETVS requirements.

For transmission to the ETVS from trunks or circuits balanced to ground with ground isolation:

- a) The ETVS shall provide a nominal impedance of 600 ohms for two-wire and four-wire trunks and circuits, with an option of 900 ohms for two-wire trunks and circuits;
- b) The ETVS shall receive at a the appropriate power level for the trunk or circuit as given in the analog transmission plan (paragraph 40.2.1.1);
- c) For site adaptation, the ETVS shall provide a range of adjustment of input power level between +12 and -16 dB relative to the level at the zero transmission level point specified in the analog transmission plan, and shall permit qualified government personnel to make this adjustment.

Note: The ETVS can support zero loss lines by means of the above adjustments.

60.2.7. Central office caller identification.

- a) The ETVS shall provide means to decode and display automatic number identification (ANI) that may be provided by the local central office on each circuit that is accessible via the public network.
- b) The ANI display may be installed in the central equipment area, but shall be accessible and readable by operational (ATC) personnel.
- c) The ANI display shall store and display the numbers (if available) of the last ten incoming calls on the circuit.

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APPENDIX G: DIGITAL G/G COMMUNICATIONS INTERFACES

70. Digital G/G communications interfaces.

70.1. Description and remarks.

This appendix presents functional and interface requirements for connecting the ETVS to certain digital transmission carriers (i.e., T-1, integrated services digital network or ISDN) to be furnished by the government.

The government recognizes the inherent advantages and growing availability of digital carrier services and wishes to ensure that the ETVS is ready to take advantage of these services wherever and whenever cost-effective.

70.2. Requirements.

70.2.1. Functional requirements.

70.2.1.1. T-1.

- a) The ETVS shall interface to government furnished point-to-point T-1 carriers using DS-1 signal format for the exchange of voice communications with other facilities .
- b) The ETVS shall support full-duplex T-1 service.
- c) The ETVS shall support all IP functional interfaces using both inband (e.g., SF or voice) and robbed bit supervision signaling.
- d) The ETVS shall support fractional T-1 service having 1, 2, 4, 6, 8, or 12 DS-0 channels.
- e) The ETVS shall permit trained government personnel to change the configuration of each DS-1 channel (i.e., change assignment of channels to DA selectors or IA access codes or trunk groups) as a site maintenance action.

70.2.1.2. ISDN.

- a) The ETVS shall interface to government furnished connections to the ISDN at primary (23B + D) rate.

- b) The ETVS shall be capable of sending and receiving D-channel information for call addressing, setup, and control.
- c) The ETVS shall permit operators to use ISDN connections to make all IP call operations.

70.2.2. Interface requirements.

70.2.2.1. T-1.

- a) The ETVS shall encode and decode speech (i.e., analog/digital and digital/analog conversion) in accordance with AT&T PUB 43801.
- b) The ETVS shall originate and receive bipolar signaling with eight-zero substitution (B8ZS) line coding as specified in NAS-IR-42004400.
- c) The ETVS shall accommodate extended superframe (ESF) in accordance with NAS-IR-42004400.
- d) The ETVS T-1 signal shall be channelized into 24 channels and shall use robbed-bit signaling as specified in NAS-IR-42004400.
- e) Synchronization between ETVS and the network shall be in accordance with Bellcore Technical Advisory TA-NPL-000436.
- f) The ETVS shall furnish cabling for the connection of DS-1 signals to the government intermediate distribution frame; the cable shall meet the requirements of NAS-IR-42004400.
- g) The ETVS shall provide automatic line build-out (ALBO) if necessary to ensure proper received signal levels. The ALBO shall not degrade the DS-1 signal as measured by jitter and eye diagrams.
- h) The ETVS shall support fractional T-1 in accordance with NAS-IR-42004400.

70.2.2.2. ISDN.

The ETVS shall interface to primary rate ISDN in accordance with NAS-IR-42004400.

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APPENDIX H: AIR-GROUND COMMUNICATIONS INTERFACES REQUIREMENTS (LOCAL AND REMOTE EQUIPMENT)

80. Air-ground communications interfaces (local and remote equipment).

80.1. Description and remarks.

This appendix is intended to summarize the important characteristics of the radio interfaces found at most prospective ETVS sites. Some variation by site can be expected, and so complete details will be specified by the government at time of order.

The basic requirements presented here are intended to make the ETVS adaptable to a variety of radio control arrangements.

Figure 80-1 provides a functional illustration of the typical radio interface.

80.2. Functional requirements.

80.2.1. Audio signals

80.2.1.1. Transmit audio.

The ETVS shall furnish an audio signal to each radio transmitter comprising the radio frequency interface (i.e., main transmitter and standby transmitter) as specified by the government at time of order and as selected by the operator.

80.2.1.2. Receive audio.

The ETVS shall accept an audio signal from each radio receiver comprising the radio frequency interface (i.e., main receiver and standby receiver) as specified by the government at time of order and as selected by the operator.

80.2.2. Control signals.

80.2.2.1. Push-to-talk control (PTT).

The ETVS shall provide a circuit for PTT control corresponding to the state of PTT devices operated by appropriate ETVS operators. This signal shall have the following two states: PTT on and PTT off.

Note: The PTT circuit is always required for interfaces to A/G transmitters.

80.2.2.2. Main/standby transmitter selection (M/S TX SELECT).

The ETVS shall as directed at time of order provide a circuit for switchover between main and standby radio transmitters, corresponding to selections made by appropriate ETVS operators. This signal shall have the following two states: select main transmitter and select standby transmitter.

80.2.2.3. Main/standby receiver selection (M/S RX SELECT).

The ETVS shall as directed at time of order provide a circuit for switchover between main and standby radio receivers, corresponding to selections made by appropriate ETVS operators. This signal shall have the following two states: select main receiver and select standby receiver.

80.2.2.4. Receiver squelch break (SQUELCH BREAK).

The ETVS shall as directed at time of order provide a circuit for receipt of squelch break signals from radio receivers or remote radio control equipment providing such signals. This signal shall have the following two states: squelch broken, and squelch not broken.

Note: Not all radio equipment can provide a squelch break closure; hence, it is necessary for the ETVS to be able to generate squelch break internally using a voice-operated circuit or equivalent (see Appendix A, 10.3.1.4.3).

80.2.2.5 Voltage keying

The ETVS shall, as directed at time of order, provide +24 VDC at the radio IDF demarcation frame to be used as the voltage source for the simplex radio keying options.

80.3. Design requirements.

80.3.1. Audio signals.

80.3.1.1. Transmit audio (normal).

For transmission from the ETVS to the radio transmitter (or intermediate signaling equipment),

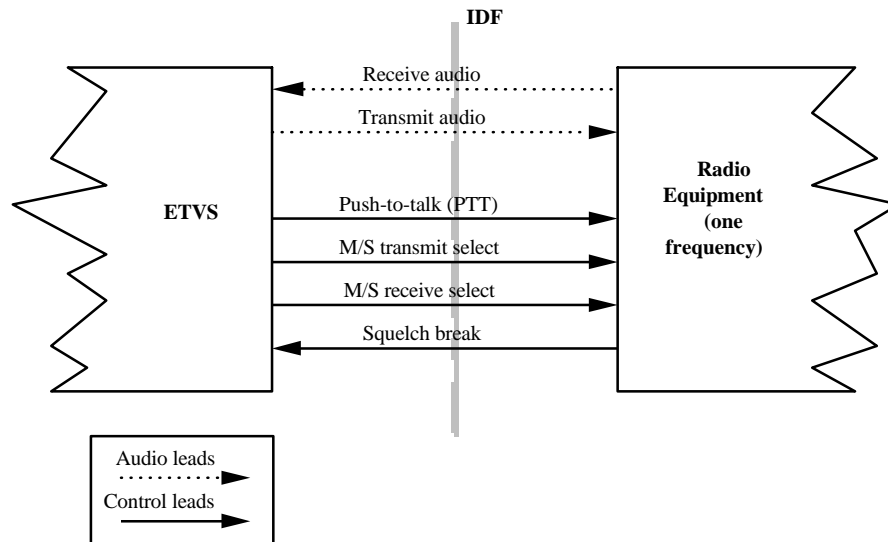


Figure 80-1: ETVS Functional Interfaces to Radio Equipment

- a) The ETVS shall provide to each transmitter interface a nominal 600 ohm center tapped transformer arrangement capable of passing up to 60 ma dc current in support of simplex PTT keying as specified in 80.3.2, and meeting the audio performance requirements of Appendix B.
- b) The ETVS shall transmit at the appropriate power level as given in the analog transmission plan (40.2.1.1).
- c) For site adaptation, the ETVS shall provide a range of adjustment of output power level between +12 and -16 dB relative to the level at the zero transmission level point (OTLP) specified in the analog transmission plan, and shall permit qualified government personnel to make this adjustment.
- d) For any step decrease of audio level within the range specified in (b) above, the audio compression, when active, shall reach 0 dBm0 \pm 1 dB within 5 milliseconds.
- e) For any step decrease of audio level within the range specified in (b) above, the audio compression, when active, shall reach 0 dBm0 \pm 1 dB within 2 seconds.
- e) The ETVS shall provide a means for qualified government personnel to disable the audio compression circuitry for maintenance purposes (e.g., to verify gain tracking linearity as specified in 20.2.4.5)

80.3.1.3. Receive audio.

For transmission to the ETVS from the radio receiver (or intermediate signaling equipment),

80.3.1.2. Transmit audio (compressed).

- a) As ordered by the government and as modified thereafter by qualified government personnel, the ETVS shall provide compression of outgoing audio for each interface to A/G transmitters.
- b) The audio compression, when active, shall maintain a constant audio level of 0 dBm0 at the transmitter interface over an audio level of -25 dBm0 to + 3 dBm0.
- c) For any step increase of audio level within the range specified in (b) above, the audio compression, when active, shall reach 0 dBm0 \pm 1 dB within 5 milliseconds.
- a) The ETVS shall provide a nominal impedance of 600 ohms.
- b) The ETVS shall receive at a the appropriate power level as given in the analog transmission plan (see 40.2.1.1).
- c) For site adaptation, the ETVS shall provide a range of adjustment of input power level between +12 and -16 dB relative to the level at the zero transmission level point specified in the analog transmission plan, and shall permit qualified government personnel to make this adjustment.

80.3.1.4. Receiver audio routing.

- a) While the associated transmitter interface has PTT active, the ETVS shall provide the following audio routing options for each radio interface:
 - 1) Mute receiver—The ETVS shall mute (i.e., disconnect) audio from the active (i.e., main or standby) radio receiver and shall not provide a squelch break indication to the operator position regardless of the receiver squelch state.
 - 2) Local sidetone—As in (1) above, in addition to which the ETVS shall provide transmit audio on the associated receive path.

Note: Above “loopback” option permits positions monitoring a frequency to hear both sides of a conversation.

- 3) Remote sidetone—The ETVS shall not alter the audio received on the active receiver.

Note: Above option is normally to be used in DoD facilities where an automatic lockout device (ALOD) is provided to control multiple facility access to a radio frequency.

- b) While the associated transmitter does not have a PTT active, the ETVS shall not alter the audio received on the active receiver (i.e., main or standby).
 - c) The option specified in (a)(1) above shall be the default unless specified otherwise by the government at time of order.
 - d) The ETVS shall permit qualified government personnel to change the audio routing option in effect.

80.3.2. Control signals – electrical characteristics.

- a) The ETVS shall provide relay contact closures to operate control circuits.

- b) Each contact closure shall support up to 60 Vdc at up to 60 milliamperes, and maximum leakage current of 100 microamperes.
 - c) Each such contact closure shall provide either normally-open (NO) or normally-closed (NC) contacts.
 - d) Typical control circuit configurations are shown in figure 80-2.

80.3.3. Control & confirmation signals – logical characteristics.

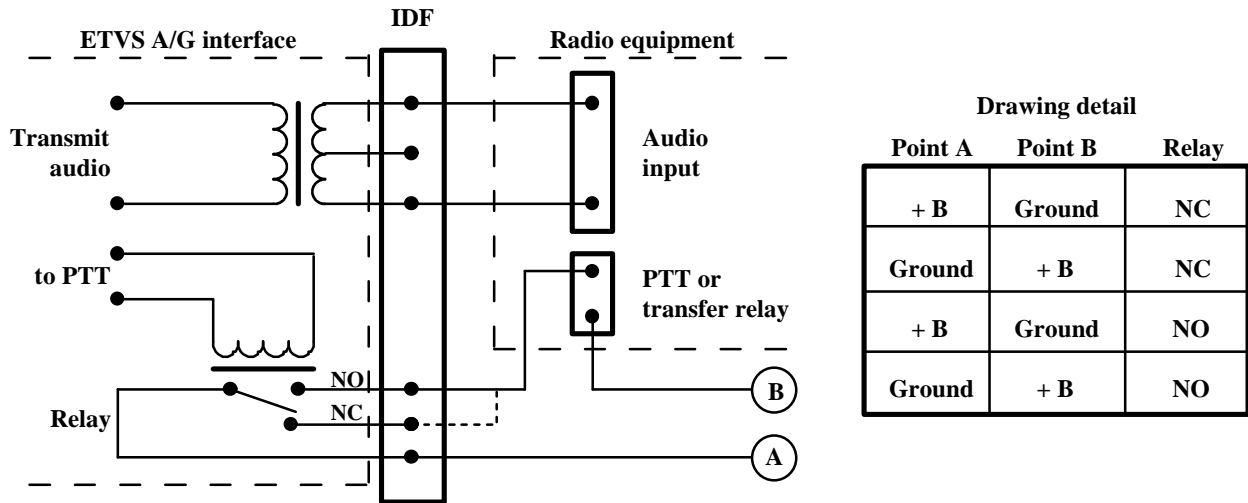
- a) The ETVS shall provide control signals and accept confirmation signals in accordance with the logical conventions of table 80-1.
 - b) For normally open control signals, closed relay circuit shall be considered to represent the “ON” state of each circuit, and an open relay circuit shall represent the “OFF” state of the circuit.
 - c) For normally closed control signals, open relay circuits shall be considered to represent the “ON” state of each circuit, and closed relay contacts shall represent the “OFF” state of each circuit.

80.3.4. Legal recorder interface.

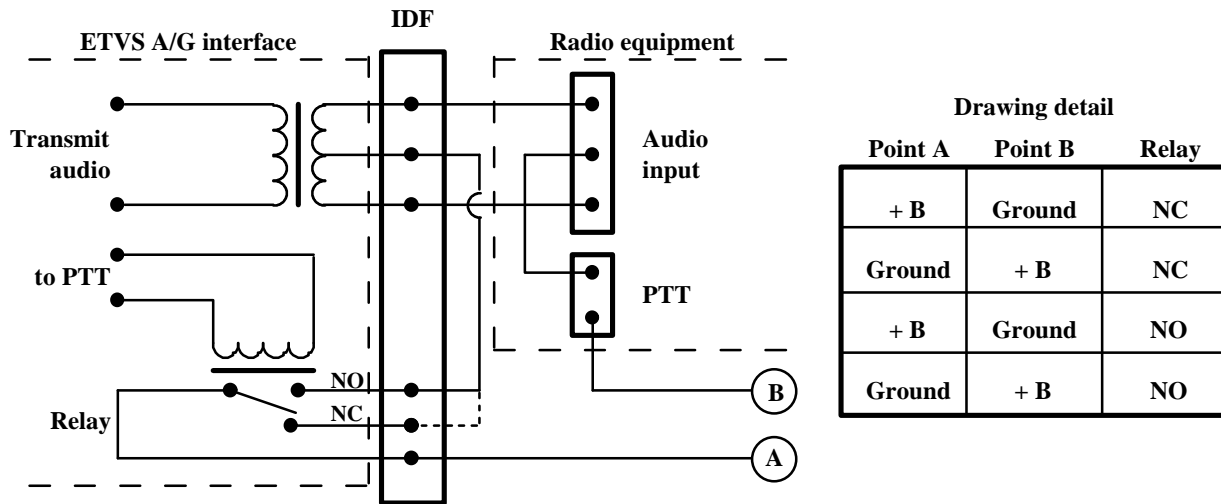
For each A/G frequency to be recorded, the ETVS shall provide a legal recorder interface meeting functional requirements of 10.3.9.1 and at a power level given in the analog transmission plan (40.2.1.1).

80.4. Connections.

- a) The ETVS shall make each interface available at a distribution frame provided by the government.
 - b) The ETVS installation shall include the connection to government-furnished batteries and grounding networks for radio control.
 - c) Pinouts, frame connections, connector types, and other related data vary by site and will be provided at time of order or at time of installation.



(a) Battery loopback and short-to-ground keying



(b) Simplex keying

Figure 80-2: Typical Radio Control Circuit Arrangememnts

Logical state	Corresponding circuit	Circuit state
PTT on	PTT	ON
PTT off	PTT	OFF
Select main transmitter	M/S TX SELECT	OFF
Select standby transmitter	M/S TX SELECT	ON
Select main receiver	M/S RX SELECT	OFF
Select standby receiver	M/S RX SELECT	ON
Squelch broken	SQUELCH BREAK	ON
Squelch not broken	SQUELCH BREAK	OFF

Table 80-1: Logical Characteristics of Radio Control Signals

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APPENDIX I: RELIABILITY, MAINTAINABILITY, AND SERVICE LIFE

90. Reliability, maintainability, and service life requirements.

90.1. Description and remarks.

This appendix provides basic requirements for reliability, maintainability, and service life that the ETVS must meet.

90.2. Reliability.

- a) The reliability of the ETVS shall be assessed from the mean time between failures (MTBF) of certain functions or services provided by ETVS. The MTBF shall be computed from considerations of the failure rates of all ETVS equipment involved in providing the function or service, the interrelationship of these components, and standard computational rules of reliability theory (e.g., series, parallel, i out of j).
 - 1) The MTBF for access to any A/G frequency from any operational or supervisory position shall not be less than 10,113 hours.
 - 2) The MTBF for access to any G/G circuit from any operational or supervisory position shall not be less than 10,113 hours.

Note: “The above 10113 hour MTBF values can be related to frequency of maintenance actions to restore that particular service.”

- b) For a fully equipped BS-3 system, the ETVS shall have a design requirement of a total component mean time to fail greater than 220 hours.

Note: “The above 220 hour MTBF value is not necessarily related to the frequency of maintenance actions to restore service.”

- c) In no case shall the failure of any single component of the ETVS affect the operation of more than one G/G circuit, A/G frequency, or position at a time.
- d) In the event that the ETVS mitigates system failures through the reallocation of resources to provide degraded operation, the following priority order shall be observed in maintaining service:
 - 1) ATC communications (most important);

- 2) Maintenance support;
 - 3) Mission reconfiguration; and,
 - 4) All other functions.
- e) The ETVS shall pass a reliability demonstration conducted according to 4.3.5.

90.3. Maintainability.

90.3.1. Time to repair.

- a) Excluding administrative and logistical time, the ETVS shall exhibit a mean time to repair of not more than 30 minutes for any single maintenance action, including time required for fault localizing, repair, test, and restoration to service.
- b) Excluding administrative and logistical time, the ETVS shall not require more than 90 minutes for any single repair action, including time required for fault localizing, repair, test, and restoration to service.

Note: “Administrative and logistical time” is that time spent on activities (such as dispatch time, travel time, paperwork, etc.) not within the control of the ETVS or its supplier.

90.3.2. Preventive maintenance.

Note: “Preventive maintenance” refers to those activities (adjustment, cleaning, replacement of consumables, etc.) that the ETVS supplier recommends be carried out on a periodic basis in order to maintain proper operation.

- a) The minimum interval for preventive maintenance of the ETVS shall not be less than six months.
- b) Preventive maintenance shall not require service interruption on more than one position or external interface at a time.
- c) Excluding administrative and logistical time, preventive maintenance of ETVS shall not require more than 2 hours per visit, regardless of system size.

90.3.3. Labor requirements.

No ETVS maintenance action shall require the simultaneous labor of more than two persons.

90.3.4. Replacement of consumable or high-wear components.

The ETVS shall not require interruption of service or desoldering for the replacement of components that are by design consumable or subject to high failure rate (e.g., light bulbs, printer ribbons or cartridges).

90.3.5. Maintainability demonstration.

The ETVS shall pass a maintainability demonstration conducted according to 4.3.6.

90.4. Service life.

- a) The ETVS shall support continuous, round-the-clock demand (i.e., 100% duty cycle).
- b) When properly maintained in accordance with this specification, the ETVS shall continue to meet the functional and performance requirements of this specification continuously throughout a service life of at least 10 years of continuous use.

APPENDIX J: AUTOMATED TERMINAL INFORMATION SERVICE (ATIS) SUPPORT

100. Automated terminal information service (ATIS) support.

100.1. Description and remarks.

This appendix contains requirements for ETVS to support ATIS, including cross-connection and monitoring.

ATIS provides verbal briefings on prevailing airport conditions to pilots via VHF radio.

ATIS crossconnect denotes the connection of outgoing ATIS voice messages from ATIS recorders to specified VHF radio transmitters. *ATIS monitoring* denotes the ability to listen to the ATIS messages via ETVS HS or LS as they are transmitted.

100.2. Requirements.

- a) As ordered by the government, the ETVS shall provide ATIS crossconnect interfaces consisting of:
 - 1) A two-wire analog voice input port for connection of government-furnished ATIS playback equipment; and,
 - 2) A two-wire analog voice output port for connection of a government-furnished ATIS transmitter.
- b) At positions designated by classmark for each ATIS cross-connect interface, the ETVS shall provide a latching DA selector for ATIS cross-connect which, when activated, shall connect the input (recorder) port to the output (transmitter) port.
- c) At positions designated by classmark for each ATIS cross-connect interface, the ETVS shall provide a latching DA selector for ATIS monitor which, when activated, shall make the ATIS recorder output audible at the position LS or HS (whichever is selected for G/G calls), regardless of whether or not ATIS cross-connect is selected.

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APPENDIX K: MANAGEMENT INFORMATION SYSTEM (MIS)

110. Management information system (MIS).

110.1. Description and remarks.

This appendix contains requirements for the ETVS to provide a management information system for tracking of routine administrative and personnel data.

The MIS will work by capturing certain data from the system operators as they start their shifts, and storing these data for later reporting to supervisors. The MIS is not intended as a means to control or restrict access to the ETVS (e.g., as with a computer system logon).

Automating the collection of data on time-on-position and training will greatly reduce the administrative workload of the air traffic supervisor. As the largest automated system that many towers are likely to have, the ETVS is best suited to collect and maintain these data.

110.2. Requirements.

110.2.1. Functional requirements.

- a) As ordered by the government, the ETVS shall provide a management information system (MIS) for collecting and reporting administrative data related to position utilization, training, and supervision.
 - b) At ETVS installations equipped with the MIS function, the ETVS shall permit authorized personnel to:
 - 1) Establish or modify the MIS data base;
 - 2) Obtain MIS data reports on both screen and in hard copy from both on-line and archive data;
 - 3) Copy on-line data to archive media; and,
 - 4) Disable and re-enable the MIS data collection function.
 - c) The ETVS shall provide a warning to the supervisory positions whenever on-line storage space for MIS data is within 48 hours of exhaustion.
 - d) The ETVS shall not restrict access to communications functions by operators due to failure to enter valid MIS sign-on codes.
 - e) Access to MIS database, reporting, and data retention routines shall be password protected.
- ##### 110.2.2. MIS data collection.
- a) Upon insertion of an HS into a vacant jack at any position, the ETVS shall visually prompt the new operator to enter a sign-on code at the position IA keypad.
 - b) The signon code shall consist of the operator's individual identifying code plus one additional code identifying the function that the operator will perform, as given below:
 - 1) Normal shift;
 - 2) Delivery of on-the-job training (OJT);
 - 3) Receipt of OJT;
 - 4) Delivery of supervisory over-the-shoulder (OTS) evaluation;
 - 5) Receipt of OTS;
 - 6) At least 4 locally-defined functions.
 - c) The ETVS shall determine whether each code entered is valid by comparing it to the MIS data base.
 - d) Whenever an operator enters a code that is found to be invalid, the ETVS shall visually prompt for re-entry of the code.
 - e) The ETVS shall determine whether the position operator identified in the sign-on code is authorized to operate the position without supervision (according to the current MIS data base entry); if not, the ETVS shall provide a visual indication to the supervisor identifying the position and the operator.
 - f) Upon successful validation of each sign-on code, the ETVS shall post a sign-on record (identifying the operator, position, function code, and sign-on time) for later data reporting use.

- g) Thirty seconds after removal of the HS from the position, the ETVS shall post an appropriate sign-off record (identifying the operator, the position, and the sign-off time) for later data reporting use.
- h) The ETVS shall permit the time-of-day recording for MIS to be synchronized to an IRIG E external time source in accordance with NAS-IR-92020000.
- i) The ETVS shall permit the operator to repeat signon with the same or different codes at any time without requiring disconnection from the position. The time of the new signon shall in such cases be counted as the time at which the old signon is terminated.
- b) Each report shall use operator names and position names (extracted from the MIS data base) along with their identifying codes.
- c) Each report shall cover the range of dates entered by the supervisor.
- d) Each report shall identify the following as selected by the supervisor:
 - 1) Time that each position was in use;
 - 2) Hours spent by each operator at each position; and,
 - 3) Hours spent by each operator in each function (normal shift, OJT, OTS, local functions, etc.).

110.2.3. MIS data base.

The MIS shall provide a database at the supervisory workstation, protected by password, allowing supervisors to enter and update the following data:

- a) Full name of each operator;
- b) Identifying code (e.g., digit sequence) for each operator;
- c) Position(s) at which each operator is authorized to work without direct supervision (by virtue of having been trained and certified);
- d) Name of function (e.g., 'ground control') fulfilled by each position (stored by position ID); and,
- e) Identification of function or activity represented by locally-defined MIS logon codes.

110.2.4. MIS data reporting.

- a) At the supervisory workstation, the ETVS shall provide a MIS data reporting facility that can write reports both on screen and in hard copy upon request.

110.2.5. MIS data retention.

- a) The ETVS shall retain the MIS database until it is updated or removed.
- b) The ETVS shall retain sign-on and sign-off records on-line (i.e., available for immediate data reporting) for at least 15 days.
- c) Whenever more than 15 days have elapsed without archiving of MIS data, the ETVS may erase old data to make room for new, but shall do so beginning with the oldest data.
- d) At the supervisory workstation, under password protection, the ETVS shall permit the operator to archive sign-on and sign-off records to 3.5-inch MS-DOS format disks in flat text (ASCII) files for future analysis using the MIS data reporting feature.

APPENDIX L: COMMUNICATIONS TRAFFIC DATA (CTD) AND SYSTEM EVENT COLLECTION AND REPORTING

120. Communications traffic data (CTD) and system event collection and reporting.

120.1. Description and remarks.

The CTD collection and reporting function will provide the accurate summary communications utilization data required by the government to make informed decisions regarding communications resource allocation, workload leveling, system studies, etc. Supervisory or maintenance personnel will use the CTD feature to run reports on selected circuits and positions covering time periods of interest.

The system event reporting function will provide more detailed information on ETVS position activity for use by supervisory and maintenance personnel in system troubleshooting, incident investigation, and workload assessment.

120.2. CTD requirements

120.2.1. Functional requirements

- a) Via the supervisory and maintenance workstations, the ETVS shall permit authorized personnel to:
 - 1) Obtain CTD data reports on both screen and in hard copy from both on-line and archive data; and,
 - 2) Copy on-line data to archive media.
- b) The ETVS shall provide a warning to the supervisory and maintenance positions whenever on-line storage space for CTD data is within 48 hours of exhaustion.

120.2.2. CTD collection.

The ETVS shall collect and store any real-time data required to produce the reports described below.

120.2.3. CTD reporting.

- a) The ETVS shall produce CTD reports on demand for any individual position or interface, or groupings thereof, for any requested time period over which the ETVS has collected data.

- b) The CTD reports shall identify the total number of calls incoming, the total number of calls outgoing, and the total holding time (or time utilization, or other equivalent measure) for each interface or position selected for reporting.
- c) The ETVS shall allow each report to be compiled from data stored on line or on archive disks (see below).
- d) The ETVS shall summarize data such that CTD reports may be run for time intervals as short as one hour.
- e) The ETVS shall permit the time-of-day recording for CTD to be synchronized to an IRIG E external time source in accordance with NAS-IR-92020000.

120.2.4. CTD storage.

- a) The ETVS shall provide sufficient on-line storage to accumulate at least thirty consecutive days' worth of summarized CTD.
- b) The ETVS shall provide means to copy communications traffic data on removable computer media (e.g., floppy disk) for later analysis using the CTD reporting feature.
- c) Whenever thirty days have lapsed without archiving of CTD, the ETVS may erase old data to make room for new, but shall do so beginning with the oldest data.

120.3. System event recording requirements.

120.3.1. Functional requirements.

- a) Via the supervisory and maintenance workstations, the ETVS shall permit authorized personnel to:
 - 1) Obtain system event reports on both screen and in hard copy from both on-line and archive data; and,
 - 2) Copy on-line data to archive media.

- b) The ETVS shall provide a warning to the supervisory positions whenever on-line storage space for system event data is within twenty-four hours of exhaustion.

120.3.2. System event data collection.

- a) The ETVS shall provide a system event recording capability which will record the time and nature of the following events whenever they occur.
 - 1) Activation and deactivation of relief briefing;
 - 2) Activation and deactivation of call forwarding;
 - 3) Activation and deactivation of position monitoring;
 - 4) Activation and deactivation of frequency forwarding;
 - 5) System faults and failures;
 - 6) Activation and deactivation of split operation at split positions;
 - 7) Maintenance actions requiring terminal access;
 - 8) Logins and logouts to maintenance terminals;
 - 9) Logins and logouts to supervisory terminals; and,
 - 10) Mission reconfigurations.

- b) The ETVS shall permit the time-of-day recording for system event recording to be synchronized to an external time source.

120.3.3. System event reporting.

- a) The ETVS shall produce system event reports on demand for any position or group of positions, for any requested time period over which the ETVS has collected data.
- b) The CTD reports shall identify in a chronological or log-based fashion each occurrence of the types of events identified in 120.3.2.
- c) The ETVS shall allow each report to be compiled from data stored on line or on archive disks.

120.3.4. System event data storage.

- a) The ETVS shall provide sufficient on-line storage to accumulate at least 24 consecutive hours' worth of system event data.
- b) The ETVS shall provide means to copy system event data on removable computer media (e.g., floppy disk) for later analysis using the CTD reporting feature.
- c) Whenever 24 hours have lapsed without archiving of system event data, the ETVS may erase old data to make room for new, but shall do so beginning with the oldest data.

APPENDIX M: REMOTE MONITORING SUBSYSTEM & MAINTENANCE DATA TERMINAL INTERFACE

130. Remote monitoring subsystem and maintenance data terminal interface.

130.1. Description and remarks.

This appendix provides requirements for the ETVS to be equipped with a remote monitoring subsystem (RMS) for connection to the government-furnished maintenance processor subsystem (MPS) and maintenance data terminal (MDT). The MPS and MDT, as well as the RMS, are considered to be part of the government's remote maintenance monitoring system (RMMS), which collects maintenance-related data (including alerts and alarms) from remote equipment, and provides maintenance-related commands to remote equipment. The RMMS is intended to save operating funds by reducing the need for on-site maintenance personnel.

130.2. RMS requirements.

The RMS shall meet the functional requirements of NAS-MD-793A, with the exceptions and modifications noted below.

130.2.1. Subsystem monitoring.

130.2.1.1. Data acquisition.

- a) The following portions of NAS-MD-793A do not apply to the ETVS RMS:
 - 1) 3.1.1.1 (b);
 - 2) 3.1.1.1 (c);
 - 3) 3.1.1.1 (e);
 - 4) 3.1.1.1 (f);
 - 5) 3.1.1.1 (g); and,
 - 6) 3.1.1.2 (b).
- b) The following portions of NAS-MD-793A are hereby modified to pertain to the ETVS RMS:
 - 1) 3.1.1.1 (a): "The RMS shall monitor parameters required to determine the operational status of each hardware component normally subject to automated fault detection and localizing (see 10.3.5.1.

and 10.3.5.2. of the ETVS specification) to the lowest replaceable unit (LRU) level."

- 2) 3.1.1.2 (a): "The RMS shall monitor the following conditions: (1) state of cabinet overheat sensors (see 50.3.3.7. of the ETVS specification); (2) transfers between main and reserve power for systems having reserve power system (see 50.2.3 (d) of the ETVS specification); (3) indication of less than five minutes' power remaining in reserve power system (see 50.3.2 (e) of the ETVS specification)."

130.2.1.2. Maintenance status determination.

- a) The following portions of NAS-MD-793A do not apply to the ETVS RMS:
 - 1) 3.1.2.1 (d);
 - 2) 3.1.2.1 (i, n, o, p);
 - 3) 3.1.2.1 (j, k, l);
 - 4) 3.1.2.1 (m); and,
 - 5) 3.1.2.2 (b).
- b) The following portions of NAS-MD-793A are hereby modified to pertain to the ETVS RMS:
 - 1) 3.1.2.1 (a): "The RMS shall automatically declare an alarm condition upon detection of a parameter change in any data point that would result in interruption of ATC communications."
 - 2) 3.1.2.1 (b): "The RMS shall automatically declare an alert condition upon detection of a parameter change in any data point that would not result in interruption of ATC communications."
 - 3) 3.1.2.1 (c): "The RMS shall automatically declare a return-to-normal (RTN) condition corresponding to a previously reported alarm or alert condition upon detection that the condition causing the alarm or alert has been resolved."

- 4) 3.1.2.2 (a): “The RMS shall automatically declare a state change whenever any physical reconfiguration of the ETVS has been performed (see 10.3.8. of the ETVS specification) resulting in addition or deletion of LRUs that would normally be subject to automated fault detection and localizing (see 10.3.5.1. and 10.3.5.2. of the ETVS specification).”

130.2.1.3. Maintenance data reporting.

The following paragraph of NAS-MD-793A does not apply to the ETVS RMS: 3.1.3.4 (subsystem status is implicit in LRU reporting).

130.2.2. Subsystem control.

130.2.2.1. Logon, logoff, and RMS control mode selection.

The following is hereby added to the requirements of NAS-MD-793A pertaining to the ETVS RMS: 3.2.1: “(f) The RMS shall respond to RMS control mode change commands issued by the MPS in both local and remote modes.”

130.2.2.2. Maintenance control commands.

- a) The following portions of NAS-MD-793A do not apply to the ETVS RMS:
 - 1) 3.2.2.2.1.;
 - 2) 3.2.2.2.2.;
 - 3) 3.2.2.2.3.; and,
 - 4) 3.2.2.2.4.
- b) The following portions of NAS-MD-793A are hereby modified to pertain to the ETVS RMS:
 - 1) 3.2.2.1 (b): “The RMS shall process maintenance control commands from the local MDT, and RMS control mode change commands from the MPS, when the RMS control mode indicates local control.”

- 2) 3.2.2.2.5: “The RMS shall process diagnostic commands from the MDT or MPS in either one of the following ways as most appropriate to the design of the ETVS fault detection and localizing function: (a) By requesting the system to run the appropriate user-initiated diagnostics (if any) and forwarding the results of these diagnostics in the response to the diagnostic command; or (b) By responding with the results of the most recent fault detection and localizing results for any pending faults, or reporting freedom from faults if there are no pending faults.”

130.2.2.3. Automatic control functions.

- a) The following portion of NAS-MD-793A does not apply to the ETVS RMS: 3.2.3.2.
- b) The following portion of NAS-MD-793A is hereby modified to pertain to the ETVS RMS: 3.2.3.1: “The RMS shall use the ETVS fault localizing function (see 10.3.5.2. of the ETVS specification).”

130.2.3. Maintenance operations support.

130.2.3.1. RMS control mode change.

The following portions of NAS-MD-793A do not apply to the ETVS RMS:

- a) 3.3.3 (b); and,
- b) 3.3.4 (b).

130.2.4. NAS subsystem status.

Paragraph 3.4 of NAS-MD-793A does not apply to the ETVS RMS.

130.2.5. Interfaces.

- a) The following portions of NAS-MD-793A are hereby modified to pertain to the ETVS RMS:
 - 1) 3.9.1 (a): “The RMS shall, as approved by the government, communicate with the MPS via dial-up telephone line, supplying a local modem compatible with the Hayes “AT” command set and CCITT V.32 (bis) modulation.”

- 2) 3.9.1 (d): “The RMS shall interface with the MPS in accordance with NAS-IR-51035101, using one of the interface methods described in Appendix A of NAS-IR-51035101 as approved by the government. Optionally, if approved by the government, the RMS shall communicate with the MPS using the dial-up interface described in 3.9.1 (a) and 3.9.2.”
- b) The following is hereby added to the requirements of NAS-MD-793A pertaining to the ETVS RMS: 3.9.3. MDT interface: “The RMS shall interface to the MDT using asynchronous byte-aligned data transmission in accordance with EIA-232D, operating at rates of up to 19,200 bits per second, over direct cables or government-furnished dial-up modem facilities. The RMS shall furnish screen cursor control to support the MDT emulation of a Digital Equipment Corporation model VT-100 display terminal.”

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APPENDIX N: VOICE SWITCHING AND CONTROL SYSTEM (VSCS) TO VOICE SWITCH INTERFACE (TYPE 20 TRUNKS)

140. VSCS to voice switch interface (type 20 trunk).

140.1. Description and remarks.

This appendix contains the requirements for ETVS to interface with type 20 trunks. Type 20 tieline trunks are two-way, four-wire, point-to-point circuits between air traffic control positions located at two different sites. These circuits are always contained in trunk groups and are dial selective inbound and outbound with calling party identification. Incoming and outgoing address signaling utilizes DTMF tones. Supervisory signaling will be wink start or immediate dial utilizing SF signaling.

140.2. Requirements.

The ETVS shall provide the functional interfaces of the VSCS type 20 trunks in accordance with 3.2.8.3.10 of NAS-IC-42018404.

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APPENDIX O: SIZE AND CAPACITY REQUIREMENTS

150. System size and capacity.

150.1. System capacity.

150.1.1. Number and type of positions.

- a) The ETVS shall provide at least 150 operational positions.
 - b) The ETVS shall permit at least 5 out of the 150 positions to be used as supervisory positions (with the addition of supervisory terminals and other equipment as required).
 - c) The ETVS shall provide one maintenance position (i.e., integrated with the central equipment).
 - d) The ETVS shall permit at least 5 out of the 150 positions to be used as remote maintenance workstations (with the addition of remote maintenance terminals and other equipment as required).
 - e) The ETVS shall permit at least 50 out of the 150 positions to be split in accordance with 10.3.3.10
- 1) Receive only with single (main) receiver;
 - 2) Receive only with main and standby receivers (requiring main/standby transfer capability);
 - 3) Transmit and receive with single (main) transmitter and receiver); and,
 - 4) Transmit and receive with main and standby transmitters and receivers (requiring main/standby transfer capability.
 - c) In addition to the above, the ETVS shall accommodate paired frequencies, in which UHF and VHF equipment are operated from the same control circuits and audio lines.

150.1.3.2. G/G circuits and trunks.

- a) The ETVS shall provide interfaces for at least 200 individual G/G circuits, trunks, or channels.
- b) As designated by the government at the time of order, each such interface shall support:

150.1.2. Position equipment capacity.

- a) The ETVS shall provide operational position equipment capable of providing access to at least 30 A/G frequencies (1 frequency = 1 main/standby pair).
 - b) The ETVS shall provide operational position equipment capable of providing access to at least 50 DAs selectors.
 - c) The ETVS shall provide position equipment with less than the maximum capacity for positions that require fewer selectors.
- 1) One of the two-wire or four-wire analog circuit types listed in Appendix F of this specification; or,
 - 2) One DS-0 level digital voice channel on a T-1 carrier;
 - 3) One ISDN bearer channel with access to the D channel of a PRI carrier.

150.1.3.3. Door release interfaces.

The ETVS shall provide up to 5 door release interfaces as ordered by the government.

150.1.3. External interfaces.

150.1.3.1. A/G interfaces.

- a) The ETVS shall provide interfaces for up to 200 A/G frequencies (one frequency = one main/standby pair).
- b) Each frequency interface shall support one of the following, as identified by the government at time of order, based on the requirements of Appendix H of this specification:

150.1.3.4. Remote terminals.

The ETVS shall provide at least 5 remote terminal interfaces as ordered by the government.

150.1.3.5. Remote alarm panel.

The ETVS shall provide at least 2 remote alarm panels as ordered by the government.

150.2. Installation space requirements.

150.2.1. Operational position equipment.

- a) The total panel space and volume that the government can make available for installation of position equipment will vary by facility and by position. ETVS position equipment shall be as small as possible (while still meeting all other requirements of this specification), but in no case shall be larger than a cumulative total of 400 square inches panel cutout area by 12 inches of depth (including clearance for cabling and connectors).
- b) If required, additional equipment to support the position equipment may be installed adjacent to the console in a space no larger than 9 inches high, 5 inches wide, and 22 inches deep (including clearance for cabling and connectors).
- c) Smaller position equipment configurations are preferred, provided they can meet all other requirements of this specification.
- d) The ETVS shall provide a choice of position equipment configurations to suit various requirements, such as compact integrated panels (i.e., with fixed number of frequencies and DA selectors), touch-entry displays, standard rack mount units, and modularly-expandable position equipment.
- e) Except in the case of remotized position equipment, all ETVS position equipment shall be powered from the central equipment; the government will make no power available in the tower cab or approach control area for individual position equipment units.

150.2.2. Supervisory position.

In addition to the space to be made available for operational position equipment for supervisory communications, the supervisory position shall fit within a 3 by 3 foot area of desktop space.

150.2.3. Maintenance position.

- a) Terminal equipment required for maintenance position use shall fit within a 3 by 3 foot area of desktop space, or else shall be rack-mountable with the rest of the system central equipment.
- b) Other equipment required by the maintenance position (e.g., test point access, duplicate position equipment, indicators, power supply monitoring and service points, etc.) shall fit within the space allocated to the central equipment.

150.2.4. Remote maintenance terminals.

In addition to the space to be made available for operational position equipment for maintenance communications, the remote maintenance terminal shall fit within a 3 by 3 foot area of desktop space.

150.2.5. Central equipment floor space.

- a) The ETVS central equipment shall include all equipment necessary to support ETVS operations except for operational positions, and supervisory and maintenance terminals.
- b) The ETVS central equipment shall fit within the floor space allocations by system size of Table 150-1 including aisle space and space for equipment access.

150.2.6. Separation of equipment.

- a) The ETVS shall permit operational position equipment, maintenance terminals, and supervisory terminals to be located up to 500 cable feet away from the central equipment.
- b) As ordered by the government, the ETVS shall provide operational positions, maintenance terminals, and supervisory terminals that can be located as much as 15,000 cable feet away from the central equipment.

System class ¹	Operator Positions ²	A/G & G/G Interfaces ²	Maximum floor space
Basic system 1 (BS-1)	8	24	6 feet x 4 feet
Basic system 2 (BS-2)	16	40	8 feet x 8 feet
Basic system 3 (BS-3)	40	100	8 feet x 12 feet
Basic system 4 (BS-4)	80	200	12 feet x 13 feet
Basic system 5 (BS-5)	150	400	13 feet x 14 feet

1. Basic system classes are defined in contract schedule
2. As defined in contract schedule; provided here for information only

Table 150-1 System central equipment floor space allocations

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APPENDIX P: FOUR JACK POSITION OPERATION

160. Four Jack Position Operation.

160.1. Description and remarks.

This appendix defines the requirements for the ETVS to provide each position with the capability to have four operators connected to each position.

160.2 Requirements.

160.2.1 HS jack modules.

The following shall be used in place of 10.3.3.4 in Appendix A of this specification.

- a) The ETVS shall provide one jack module ("primary" jack module) per position, having trainee and instructor jack sets.
- b) As ordered by the government, the ETVS shall provide one additional jack module ("secondary" jack module) for selected positions, having trainee and instructor jack sets.
- c) Each jack set shall accommodate HS instruments as specified in 40.2.3.1 and 40.2.3.2, having both earpiece and mouthpiece circuits.
- d) In each primary and secondary jack module, the instructor jack set shall be placed immediately to the left of the trainee jack set.
- e) The ETVS shall permit any jack set to be used for all communications functions.
- f) The ETVS shall route all HS directed audio from A/G and G/G calls to the earpiece of each jack having a HS device plugged in.
- g) For each call requiring PTT, the ETVS shall permit a higher-priority operator to preempt communications by any lower-priority operator by activation of PTT. The order of precedence for such preemption shall be:
 - 1) Primary instructor (highest priority);
 - 2) Primary trainee;
 - 3) Secondary instructor (if provided); and,

- 4) Secondary trainee (if provided, lowest priority).

- h) While PTT option 1 is in effect (10.3.2.6) and a G/G call is in progress or PTT option 2 is in effect and an incoming OVR call is in progress, the ETVS shall make each occupied jack HS microphone device audible on the call and shall furnish call audio to each occupied jack HS earpiece.
- i) While PTT option 2 is in effect (10.3.2.6) and for each G/G call in progress, except incoming OVR calls, the ETVS shall make the occupied jack HS microphone device having PTT activated and subject to PTT preemption in g) above audible to the G/G call and shall furnish call audio to each occupied jack HS earpiece.
- j) For A/G communication, the ETVS shall make the occupied jack HS microphone device having PTT activated and subject to PTT preemption in g) above audible to the A/G call and shall furnish call audio to each occupied jack HS earpiece.
- k) While any HS device microphone is active, the ETVS shall supply sidetone to that HS device.

160.2.2 Footswitch operation.

The following shall be used in place of 10.3.3.9 in Appendix A of this specification.

- a) As identified at time of order, each operational position shall be provided with a removable pedal-type footswitch for activation of PTT.
- b) When only one HS device is plugged into the primary jack module (either trainee or instructor jack), the ETVS shall permit the footswitch to be used as an alternate PTT device, i.e., in parallel with the HS PTT device.
- c) When one HS device is plugged into the instructor jack of the primary jack module, and one other HS device is plugged into the trainee jack of the primary jack module, the ETVS shall permit the footswitch to be used as an alternate PTT device for the trainee operator only, i.e., in parallel with the trainee jack HS PTT device only (with instructor jack operator retaining preemption capability in accordance with 10.3.3.4 above).

- d) The footswitch shall not operate with the secondary jack module.

160.2.3 Split positions.

The following shall be used in place of 10.3.3.10 subparagraph d).

- d) When combined, the position:
 - 1) Shall permit a single operator to operate all position functions;
 - 2) Shall direct all position LS audio to the A/G loudspeaker, the G/G loudspeaker shall be inoperable;
 - 3) Shall permit any jack to be used for position functions in accordance with 10.3.3.4, where the A/G jack module shall be the primary jack module and the G/G jack module shall be the secondary jack module;
 - 4) Shall enable the A/G relief briefing selector to control position relief briefing and shall inhibit operation of the G/G relief briefing selector; and,
 - 5) Shall operate in all other respects as a single position.

160.2.4 Relief briefing.

The following shall be used in place of 10.3.3.11 subparagraph b).

- b) Upon selection of the relief briefing selector, the ETVS :
 - 1) Shall establish two-way audio connections between all occupied jack HS devices without activation of PTT;
 - 2) Shall route audio to the legal voice recorder in accordance with 10.3.3.14; and,
 - 3) Shall provide an active indication at the relief briefing selector of the affected position.

160.2.5 Legal voice recording of positions.

The following shall be used in place of 10.3.3.14.

- a) The ETVS shall provide connectivity to a government-furnished voice logging recorder at the IDF to record all A/G and G/G calls and relief briefings at each operational position.
- b) For each position not in relief brief mode, the ETVS shall provide to the legal recorder the following audio onto a single interface:
 - 1) Audio signal furnished to the LS after volume control, excluding the chime;
 - 2) Audio signal furnished to the headset earpiece after the volume control and amplitude limitation of the highest priority HS jack occupied as follows: primary instructor (highest priority), primary trainee, secondary instructor, secondary trainee (lowest priority); and,
 - 3) Audio signal furnished by the position to called party in accordance with 10.3.3.4 subparagraphs g), h), i) and j).
- c) For each position having relief brief mode active, the ETVS shall provide to the legal recorder the following audio onto a single interface:
 - 1) Audio signal furnished to the LS after volume control, excluding chime; and,
 - 2) The microphone audio of each occupied jack HS device.
- d) For each split position, the ETVS shall provide the following legal recorder interfaces:
 - 1) A/G portion – The ETVS shall provide a single interface to the legal recorder at the IDF containing the A/G jack module and A/G loudspeaker audio in accordance with b) and c) above; and,
 - 2) G/G portion – The ETVS shall provide a single interface to the legal recorder at the IDF containing the G/G jack module and G/G loudspeaker audio in accordance with b) and c) above.

APPENDIX Q: VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (VRTM)

170. Verification Requirements Traceability Matrix (VRTM).

170.1. Description and remarks.

This appendix defines verification requirements for the ETVS. A more detailed description of this VRTM can be found in section 4, Verification Requirements, of this specification.

Verification methods are listed in the VRTM as Inspection (I), Analysis (A), Test (T), or Demonstration (D). An (X) in the verification requirements traceability matrix (VRTM) indicates that the government has discretion on whether to conduct verification of that requirement during the identified phase. A dash (—) indicates that the item is not anticipated as a test verification requirement.

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APPENDIX R: TED POSITION ENHANCEMENT AND CONSOLIDATION

180. TED position enhancement operation.

180.1 Description and remarks.

This appendix defines the requirements for the TED position enhancement effort. The TED enhancement effort combines a number of functional enhancements and an electronics consolidation effort (i.e., elimination and replacement of a card-file). This Attachment describes the design requirements of a new ETVS single board TED position interface.

180.2 Requirements.

180.2.1 General.

- a) With exceptions as noted in the following paragraphs, all requirements of FAA-E-2894 shall be met with the new design.
- b) The design of the new ETVS single board TED position interface shall incorporate an embedded micro-controller for processing, a Field Programmable Gate Array (FPGA) for audio attenuation and summing, and a Digital Signal Processor (DSP) for unwanted tone removal signal processing.
- c) The FPGA shall provide key functionality and communication in the position between the two MT-8930 ISDN S-links, the DSP, four dual u-law CODECs, and the local processor's ISA bus.
- d) The design of the new ETVS single board position interface shall not affect the human interfaces of the position (i.e., position volume controls, illumination controls, etc.) and shall be transparent to the user.
- e) The hardware design shall be integrated with both the tower and TRACON TED configurations and provided for first article testing to support the immediate baselining and production of systems utilizing the new position.
- f) The functionality of the TED and the ETVS performance and switching functionality shall not be affected in any way by this redesign effort.

- g) The design shall allow for mechanical connection to the TED display or for separate mounting depending on the installed site requirements.
- h) The TED and associated position hardware shall be able to be located up to 30 feet from the single board interface.
- i) Appropriate mechanisms (i.e. "hooks") shall be provided in the design to permit downloading parameters from the SCT to enable setting audio levels, amplitude limiting levels, sidetone and volume control adjustment ranges and other audio parameters available at the position. (Note: The design and incorporation of this capability into the SCT is not included in this effort.)

180.2.2. Micro-controller.

- a) The redesigned single board TED position and the present ETVS TED position shall be interchangeable at the ISDN S-link level.
- b) No hardware or software changes to the TOP cards in the central ETVS racks shall be required.
- c) The redesigned position shall be capable of operating in the combined and split configuration in accordance with all the requirements of FAA-E-2894.
- d) The position, largely because of the LCD touch screen display and software requirements, shall be a "PC equivalent".
- e) Pentium or 486 level processors, with BIOS ROM's, shall be used.
- f) Two highly integrated graphics controller chips shall operate the main and split LCD displays.
- g) Flash memory shall replace the current hard drive to reduce space, position noise, maintenance, and boot-up time.

180.2.3. Field programmable gate array (FPGA).

The FPGA tasking shall include, but is not necessarily limited to, audio switching, attenuation, developing the timing for other chips on the board, MUXing the audio inputs into a parallel data stream, converting the

stream to linear audio, and interfacing with the Mitel 8930 ISDN Chips.

180.2.4. Digital signal processor (DSP).

- a) The new position shall be capable of detecting unwanted tones and removing them from the headset audio path.
- b) This function shall be done in the DSP to provide flexibility of design.
- c) The DSP shall process the audio channels by removing unwanted audio tones which appear in the audio passband and performing HS jack volume limiting required by paragraph 10.3.3.6 of FAA-E-2894, and supply an ST-stream carrying the values of up to eight audio channel in mu-law format for the CODECs.
- d) The requirements of the unwanted tones notch filter shall be as follows:
 - 1) Notch up to two tones when either voice or no voice is present in the audio band between 300 and 3000 Hz.
 - 2) Do not notch voice by misinterpreting it as a tone.
 - 3) Do not notch information tones or other wanted information (wanted information includes ringback signals, call progress indicators, DTMF tones, momentary audible indications (zip tones), unauthorized tones, busy tones and any other auditory information designed into the system that must reach the operator to permit full performance in accordance with FAA-E-2894).
 - 4) Provide a visual and an audible indication at the position when any enabled notch filter is activated or deactivated.
 - 5) Provide maintenance personnel a means of disabling and enabling the notch filter from the position.
 - 6) Tone notching attack time shall be no greater than 250 ms. Release time shall be no greater than 50 ms.

- 7) The depth of the notch(es) introduced shall be at least 30 dB for one tone and at least 24 dB for each of two tones.
- 8) The filter(s) shall activate for unwanted tone or tones at or above a level equal to – 35 dBm each at the headset jack.

180.2.5. Audio circuits.

Sufficient audio circuitry shall be provided in the design to provide the necessary audio processing, switching, amplification, impedance matching, power output and other necessary capability to drive the position headsets and speakers.

180.2.6. HS jack volume limiter.

The following shall be used in place of 10.3.3.6 in Appendix A of this specification.

- a) As a means to protect operators' hearing, the ETVS shall implement an audio compression function in the position DSP after any tone elimination function, having the following characteristics;
 - 1) At any frequency between 300 and 3000 Hz and for a signal having a power level of -9 dBm or greater, the audio compression function shall limit the power of the signal going to the HS jack to -9 dBm \pm 1 dB into 600 ohms.
 - 2) For a step change in signal level into the compression function going from a level of -14 dBm to a level of -4 dBm, the level of the signal going to the headset shall settle to within +/- 2 dB of its final steady state within 10 ms.
 - 3) For a step change in signal level into the compression function going from a level of -4 dBm to a level of -14 dBm, the level of the signal going to the headset shall settle to within +/- 1 dB of its final steady state within 450 +/- 150 ms.
 - 4) Sidetone, as defined by paragraph 10.3.3.7 shall not be subject to audio compression as defined herein.
- b) The ETVS shall absolutely limit any signal into each HS jack to no more than -5 dBm \pm 1 dB,

regardless of input level. This function shall be independent of and located after the DSP.

180.2.7. Hand-held microphone.

The ability to utilize a standard hand mike shall be added to the position. The following shall be added to the requirements of Appendix A, 10.3.3.4:

- k) At each position, the ETVS shall provide a handheld microphone jack when specified at time of order to accommodate a GFE hand mike, (National Stock Number(NSN))-5965-01-167-2259) which will comply with FAA-E-2162 for electrical and acoustic performance.

180.2.7.1. Hand-held microphone operation.

- a) Each ETVS operational position shall be provided the capability of accepting a removable handheld microphone when specified at time of order.
- b) When the microphone device is connected to an operational position, it shall act in parallel to the HS device connected to the trainee jack of the position.

- c) When the hand microphone is used alone (i.e., without any HS instruments connected to any jack), the ETVS shall transfer all incoming calls for the position to the LS, regardless of the state of HS/LS selectors for G/G calls and frequencies.
- d) When the hand microphone is used in conjunction with any other HS instrument connected to either of the dual jacks, control of the HS/LS selection shall be provided in accordance with 10.3.3.15.

180.2.8. Legal voice recording of the position.

Legal voice recording shall be in accordance with Appendix A, paragraph 10.3.3.14, with the exception of the use of the following terms in place of existing terms in Table 10-2.

$E_T(t)$ = audio signal to trainee HS earpiece jack after-volume control and amplitude limitation without position provided sidetone.

$E_I(t)$ = audio signal to instructor HS earpiece jack after-volume control and amplitude limitation without position provided sidetone.

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